Final

MERCER CORRIDOR PROJECT WEST PHASE

Transportation Discipline Report

May 2012

Prepared for
Seattle Department of Transportation

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AWV&SRP	Alaskan Way Viaduct and Seawall Replacement Project
FHWA	Federal Highway Administration
GIS	geographic information system
I-5	Interstate 5
NEPA	National Environmental Policy Act
ROW	right-of-way
SDOT	Seattle Department of Transportation
WSDOT	Washington State Department of Transportation

CHAPTER 1
Introduction

The Mercer West Project will complete the City's vision for a direct, two-way connection between I-5 and Elliott Avenue West continuing the segment of work constructed by the Mercer East Project. Along with new crossings of Aurora Avenue provided by the Alaskan Way Viaduct and Seawall Replacement (AWV) Program, it will greatly enhance the connection between the South Lake Union urban center and the Uptown urban center, including Seattle Center.

The project Alternative includes:

- Converting Mercer Street to two-way operation with two lanes in each direction and turn pockets between Fifth Avenue North and Queen Anne Avenue North;
- Converting Roy Street to a two-way street with bicycle lanes between Fifth Avenue North and Queen Anne Avenue North;
- Potentially adding an extended eastbound truck climbing lane on West Mercer Place east of Elliott Avenue West intersection;
- Conversion of Queen Anne Avenue North from a one-way southbound operation to a two-way operation between Roy Street and Mercer Street; and,
- Conversion of First Avenue North northbound from a one-way northbound operation to a two-way operation between Mercer Street and Roy Street.

Organization of the Report

The Transportation Discipline Report comprises the following chapters:

- Chapter 2: Description of Alternatives: This chapter describes the various alternatives that are evaluated in this report.
- Chapter 3: Methodology: This chapter describes the methods used to predict, assess and describe transportation system performance and impacts.
- Chapter 4: Affected Environment: This chapter describes the existing transportation conditions.
- Chapter 5: Environmental Consequences: This chapter describes the future (Year 2015 and 2030) performance of transportation facilities and assesses each alternative under predicted future conditions.
- Chapter 6: Mitigation: This chapter discusses the impact of construction on transportation conditions and recommends mitigations, as well as discusses possible mitigations for those consequences that require mitigation as a result of the proposed project.

CHAPTER 2
Description of Alternatives

The City of Seattle, Washington, in cooperation with the Federal Highway Administration, proposes to make improvements to the Mercer Corridor, which includes Mercer and Roy Streets and adjoining cross streets, in the Uptown neighborhood of Seattle. The Mercer West Two-way Conversion Project will complete the City's vision for a direct, two-way connection between I-5 and Elliott Avenue West.

The project area covered in this analysis includes Mercer Street and West Mercer Street from Fifth Avenue North to Fifth Avenue West and Roy Street and West Roy Street from Aurora Avenue North to Fifth Avenue West (Exhibit 2-1). The purpose of the project is to improve local safety, access, and circulation within the Uptown neighborhood for motorized vehicles, bicycles and pedestrians, and to provide for more direct movement of traffic and freight through the corridor.

SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)

Mercer West Corridor. 210152
Exhibit 2-1
Project Vicinity

Currently, from Fifth Avenue North to First Avenue North, Mercer Street is a one-way principal arterial with four eastbound lanes, operating as a couplet with Roy Street. Roy Street is a principal arterial with two westbound lanes from Fifth Avenue North to First Avenue North and three westbound lanes from First Avenue North to Queen Anne Avenue North. West of First Avenue North, Mercer Street, which becomes West Mercer Street at Queen Anne Avenue North, is a two-way street. West of Queen Anne Avenue North, West Roy Street is a two-way street. Roy Street is also a two-way street to the east of Fifth Avenue North.

The project would modify channelization and signals to replace the existing Mercer/Roy couplet with a two-way Mercer Street, which would eliminate the extra turns required to travel from east to west through this area and reduce vehicle and pedestrian conflicts. The project would also convert Roy Street to a two-way street with bicycle lanes between Fifth Avenue North and Queen Anne Avenue North.

Build Alternative

The Build Alternative would replace the existing Mercer/Roy couplet with a two-way Mercer Street, which would eliminate the extra turns required to travel from east to west through this area and reduce vehicle and pedestrian conflicts. The Build Alternative would also convert Roy Street to a two-way street with bicycle lanes between Fifth Avenue North and Queen Anne Avenue North.

Mercer Street/West Mercer Street Improvements

Mercer Street would operate as a two-way street, with two lanes in each direction (see Exhibit 2-2 and Exhibit 2-3). This would be accomplished by restriping lanes, adding appropriate signs and signals, and modifying an existing curb bulb to provide room for two lanes in each direction. Other changes would include left-turn lanes at some intersections and modifications to parking. Curb ramps would be installed at locations where they are missing to comply with American with Disability Act (ADA) requirements. Curb bulb modification and ADA improvements could lead to minimal storm drainage improvements as required by governing codes. All changes to Mercer Street between Fourth Avenue North and Queen Anne Avenue North would be within the existing street width and right-of-way. Minimal changes could be made to sidewalks, street trees, or planting strips. Right-of-way will be required along the south side of Mercer Street in the block between Fourth Avenue North and Fifth Avenue North to widen Mercer Street and transition to the future widened, six-lane Mercer Street Underpass east of Fifth Avenue North (part of the Alaskan Way Viaduct Replacement Project).

West of Queen Anne Avenue North, West Mercer Street would remain a two-way street, and minimal changes could be made to sidewalks, parking, street trees, or planting strips. Pedestrian crossing enhancements, such as curb bulbs or a median refuge, would be constructed on West Mercer Street at Fourth Avenue West or Fifth Avenue West, maintaining the existing one lane in each direction on West Mercer Street.

SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)

Mercer West Corridor. 210152

Exhibit 2-2

SOURCE: City of Seattle, 2009; NAIP (USDA), 2009 (Aerial)

Mercer West Corridor. 210152

Exhibit 2-3

Project Area

Roy Street Improvements

The one-way portion of Roy Street between Fifth Avenue North and Queen Anne Avenue North would be converted to two-way operation, reconfigured to have one travel lane in each direction, bike lanes, and parking on one side of the street. This would be accomplished by restriping lanes and adding appropriate signs and signals. The existing sidewalks would remain. The project also includes an option to convert Queen Anne Avenue North and/or First Avenue North to two-way operation between Mercer and Roy streets. Bicycle sharrows or other bicycle pavement markings would be added to West Roy Street between Queen Anne Avenue North and Fifth Avenue West.

In the block between Taylor Avenue North and Fifth Avenue North, curbs and parking would be modified within the existing right-of-way to add a westbound bicycle lane and eastbound bicycle sharrows connecting to existing bicycle facilities on Taylor Avenue North. Curb ramps would be added and modified at the intersection of Roy Street and Taylor Avenue North.

Bicycle lanes would be added to Fifth Avenue North between Mercer and Roy streets to connect the bicycle lanes on Roy Street to the bicycle path on Mercer Street that is part of the separate Mercer Underpass improvements. In addition, a later phase of the project may include installing a two-way, separated bicycle path on the west side of Fifth Avenue North between Mercer Street and Harrison Street. The bicycle path would require approximately 12 feet of right-of-way along the west side of Fifth Avenue North starting from a point mid-way between Mercer Street and Republican Street to Harrison Street. Other options under consideration for this segment of Fifth Avenue North include bicycle lanes or sharrows.

No Action Alternative

The No Action Alternative (also referred to as the No Build Alternative) is included in the environmental analysis as a comparative alternative. This alternative evaluates what would occur if the proposed project improvements were not built. This alternative serves as the baseline for measuring and comparing the effects of the Build Alternative. The No Action Alternative would not necessarily be free of environmental effects. Under the No Action Alternative, the Mercer-Roy Street couplet would remain, and no roadway, pedestrian or bicycle improvements to the project area would be made.

Other Improvements in the Project Vicinity

Under the Build Alternative or the No Action Alternative, the South Lake Union neighborhood would experience changes to the transportation infrastructure due to other projects. The planning horizon for the Mercer West Project is 2030. Additional projects proposed in the area within that timeframe include:

- Mercer Corridor Improvements Project (Mercer East)
- Alaskan Way Viaduct and Seawall Replacement Project, including the Mercer Underpass
- Ongoing mixed commercial and residential development
- Seattle Center Master Plan development
- Bill and Melinda Gates Foundation campus development

The effects of these projects, together with the proposed Mercer West improvements, are evaluated as cumulative effects in this discipline report.

Construction of the Build Alternative

Construction of the Build Alternative would be as follows:

- Construct median on Mercer Street, bicycle lanes on Roy Street, and ADA-related improvements to sidewalks and storm sewer facilities;
- Construct improvements related to changing Mercer and Roy Streets to two-way operation, including restriping, installing new controls for traffic and pedestrian crossings, and installing new traffic signage;
- Install landscaping in reconstructed planting strips and new medians, and replace any street trees removed during construction; and,
- Construct improvements related to changing Queen Anne Avenue North and First Avenue North to two-way operation between Mercer and Roy Streets, installing new controls for traffic and pedestrian crossings, and installing new traffic signage.

Within these alternatives, there are various options that are being considered. These include:

- Construction of exclusive pedestrian signal phases (all walk) at four intersections.
- Construction of a bicycle lane on Fifth Avenue North.
- Modifications to the West Mercer Place, at and to the east of the Elliott Avenue West intersection.

CHAPTER 3
Methodology

This chapter summarizes the overall study approach, as well as techniques and tools used to develop transportation data, perform operational impact analysis of existing and future traffic conditions, and assess transportation system performance of other modes and parking. This chapter also presents the analysis years, project study area limits, methods of analysis, methods of developing forecasts and analyzing operations of traffic.

Study Approach

The study approach utilized a corridor-level transportation planning analysis approach, involving data collection, investigation of existing traffic and transportation system conditions, and assessment of project future conditions.

Analysis Years and Time Periods

Assumed analysis years for the Mercer West project are:

- Existing Year: 2010
- Year of Opening: 2015
- Horizon Year: 2030

Traffic analysis is presented for both AM and PM peak hour periods for each of the analysis years. In addition, for existing year, traffic generated by a select Seattle Center event is examined to assess the event-associated traffic operations in the project area with a focus on Mercer Street. The event selected for this analysis is the Seattle Storm WNBA Finals basketball game on Wednesday September 14, 2010.

Limits of Project Study Area

The study area for the traffic analysis will include the roadway segments and intersections on Mercer Street from Fifth Avenue North to Elliott Avenue West and on Roy Street from Fifth Avenue North to Queen Anne Avenue North. The specific intersections to be studied are listed below.

- Mercer Street / Fifth Avenue North
- Mercer Street / Fourth Avenue North
- Mercer Street / Third Avenue North
- Mercer Street / Second Avenue North
- Mercer Street / Warren Avenue North
- Mercer Street / First Avenue North
- Mercer Street / Queen Anne Avenue North
- West Mercer Street / First Avenue West
- West Mercer Street / Second Avenue West
- West Mercer Street / Third Avenue West
- West Mercer Street / Fourth Avenue West
- West Mercer Street / Fifth Avenue West
- West Mercer Pl/ Elliott Avenue West
- Roy Street / Fifth Avenue North
- Roy Street / Fourth Avenue North
- Roy Street / Nob Hill Avenue North
- Roy Street / Third Avenue North
- Roy Street / Second Avenue North
- Roy Street / Warren Avenue North
- Roy Street / First Avenue North
- Roy Street / Queen Anne Avenue North

Methods of Analysis

Development of Existing and Future Volumes

Peak hour traffic volumes at study area intersections provide the basis for analyzing traffic conditions during peak periods. Traffic count data was collected by the Alaskan Way Viaduct project in 2005. An additional set of 2010 traffic counts were collected at key locations within the study area on September 15, 2010 to evaluate current traffic volumes in the study area. The 2010 and 2005 traffic count data was used to develop the existing AM and PM peak hour traffic volumes in the study area.

The AWV future forecasted volumes for the AM and PM peak hours are used as the base from which the Mercer West future forecasted volumes were developed. The assumptions of the roadway configurations made in the AWV project regarding the future roadway configuration within the Mercer West study area were updated to reflect the proposed project future lane configurations.

Existing truck volumes and percentages were obtained from the five 2010 vehicle classification counts conducted in the project area. Truck data from the AWV team was also used to supplement the data collected for this project.

Specialized Analysis Tools

The modeling tools used for the traffic analysis include EMME, Synchro and VISSIM. EMME is a macroscopic traffic forecasting tool that forecasts traffic volumes based upon a set of mathematical assumptions on trip generation, trip distribution, mode choice, time-of-day behaviors and traffic assignment logic. Synchro is macroscopic traffic simulation software that is utilized to evaluate existing and future traffic operations at study intersections. VISSIM is microscopic traffic simulation software

that is used to model the operations of the intersection of Elliott Avenue West/West Mercer Place and the eastbound truck climbing lane on West Mercer Place east of Elliott Avenue West. The measures of effectiveness that will be utilized in the analysis include delay and level-of-service.

Vehicular Traffic Operations Analysis

Existing Condition AM and PM Peak-Hour Traffic Analysis

The existing condition analysis for both AM and PM peak hour periods has been performed using Synchro. The existing condition models are based upon the Synchro models developed for the AWV project, with adjustments made to reflect the existing study area conditions, which are based on the most current (2010) field geometry and control conditions (such as signal timing and striping) for the study intersections.

Year of Opening 2015 AM and PM Peak-Hour Traffic Analysis

The year of opening 2015 analysis assumes the completion of the AWV bored tunnel Mercer Underpass improvements as described in the AWV DEIS report. This assumes the AWV bored tunnel is completed and open to traffic, along with the associated two-way operation of Mercer Street underneath Aurora Avenue (SR 99). The completion of the AWV bored tunnel and the two-way operation of Mercer Street underneath Aurora Avenue (SR 99) results in higher volumes on Mercer Street in 2015, and as a result, represents a worst case or highest traffic volume scenario for 2015.

The signal timings for future conditions are optimized based on the future forecasted volumes. Exclusive pedestrian signal phases are also examined as an option at some select intersections.

Horizon Year 2030 AM and PM Peak-Hour Traffic Analysis

AWV Project forecast volumes are used for the 2030 analysis. The horizon year 2030 analysis has been conducted for both AM and PM peak hour periods. The 2030 Synchro models have been built forward from the models previously developed for the AWV project by the AWV team. The previously modeled roadway configurations were updated to reflect the most current proposed future no-build and build alternatives configurations. The signal timings for future conditions will be optimized based on the proposed future configurations and forecasted volumes.

Special Event Analysis

The Seattle Center event traffic volumes (4 locations of pre event and 10 locations of post event) were compared to existing peak hour volumes and Level of Service (LOS) using Synchro. This allowed for an evaluation of traffic conditions immediately before and after a Seattle Center event. The event LOS and volumes were compared and contrasted with existing peak hour conditions.

Truck Traffic Impact Analysis

The existing condition vehicle classification data that was collected at select locations and the forecasted truck data provided by the AWV team have been used to identify the level of existing and future truck activity in the project corridor and what, if any, changes to the proposed design are needed to accommodate trucks. In addition, the benefits of a truck climbing lane on West Mercer Place from Elliott Avenue West to Sixth Avenue West were evaluated using VISSIM.

Collision Analysis

An analysis of collisions consists of a summary of the type and location of collisions in the project corridors. Locations with high collision rates and/or problems are highlighted. The analysis includes a summary of the number, type, and location of collisions in the corridor. The collision analysis uses the most recent 3-year data available from City of Seattle.

Transit Analysis

The impacts to transit vehicles and riders were identified by documenting the location and maneuverability of existing bus zones in the project corridor. The assessment also includes quantitatively defining transit usage at key transit stops, noting the stops that experience high volumes of pedestrian activity (ons and offs).

Parking Analysis

The existing on-street parking supply in the Uptown business area on and between Roy and Mercer Streets is identified. The type and location of existing on-street parking within the project limits is included in this analysis. Impacts to parking in the study area are assessed by describing the potential impact to the number and type of parking spaces provided under the proposed project.

Data Collection for Study Area

Data collected and used as inputs for the traffic analysis included:

- Existing roadway lane geometry including existing lane markings, channelization, lane width, turn pocket length, and pedestrian/bicycle facilities with use of aerial photographs, and field observation and photos collected in September, 2010.
- Existing control data including intersection control type, signal phasing and timing, and speed limits, collected in September, 2010.
- Existing traffic volumes at key intersections including general purpose traffic volumes and pedestrian volumes, collected in September, 2010.
- Special event data following an event at the Seattle Center on September 15, 2010.
- Existing truck volumes at three count locations along the corridor, collected in September 2010.
- Collisions records for the study area from January 1, 2007 through December 31, 2009.
- Existing transit service along the study corridors as reported by King County Metro in September, 2010.
- Parking inventory including the number and type of on-street parking spots in the business area along and between Mercer and Roy Streets in September, 2010.

CHAPTER 4
Affected Environment

The existing roadway network that would be served by or affected by the Mercer West project primarily consists of changes to Mercer Street and Roy Street. Some additional changes occur to modify single-block sections of Queen Anne Avenue North and First Avenue North open to two-way traffic between Mercer Street and Roy Street. The characteristics of these roadway facilities vary with respect to roadway geometry and lane configuration as described below.

Existing Roadway Geometries

Mercer Street is an east-west arterial. The portion from First Avenue North westward is two-way, while the portion that is east of this intersection is one-way eastbound. The two way portion has two lanes in each direction from First Avenue North to Second Avenue West, and a single lane in each direction west of this segment. The one-way portion has two eastbound lanes for a single block between First Avenue North and Warren Avenue, widening to four eastbound lanes for the remaining segment under study; the four eastbound lanes extend beyond Fifth Avenue North and under the Aurora Avenue Bypass to Dexter Avenue.

West Mercer Place is currently a two-way extension of West Mercer Street. At the western end of West Mercer Place, where the roadway terminates at Elliott Avenue, there is a short segment of two receiving eastbound left turn lanes that turn from southbound Elliott Avenue to eastbound West Mercer Place.

Roy Street in the study area is a westbound one-way street. There are two westbound lanes for the segment from Fifth Avenue North to First Avenue North, and a short three-lane segment from First Avenue North to Queen Anne Avenue North. The approaches to the study area from the east (east of Fifth Avenue North) and the west (west of Queen Anne Avenue) are two-way with a single lane in each direction.

The study area is shown in Exhibit 4-1, which also illustrates which intersections are controlled by traffic signals and which are not.

Exhibit 4-1: Study Area Intersections

Existing Traffic Volumes

Peak hour traffic volumes at study area intersections provide the basis for analyzing traffic conditions during peak periods. The AM existing traffic volumes are shown in Exhibit 4-2; PM existing traffic volumes are shown in Exhibit 4-3.

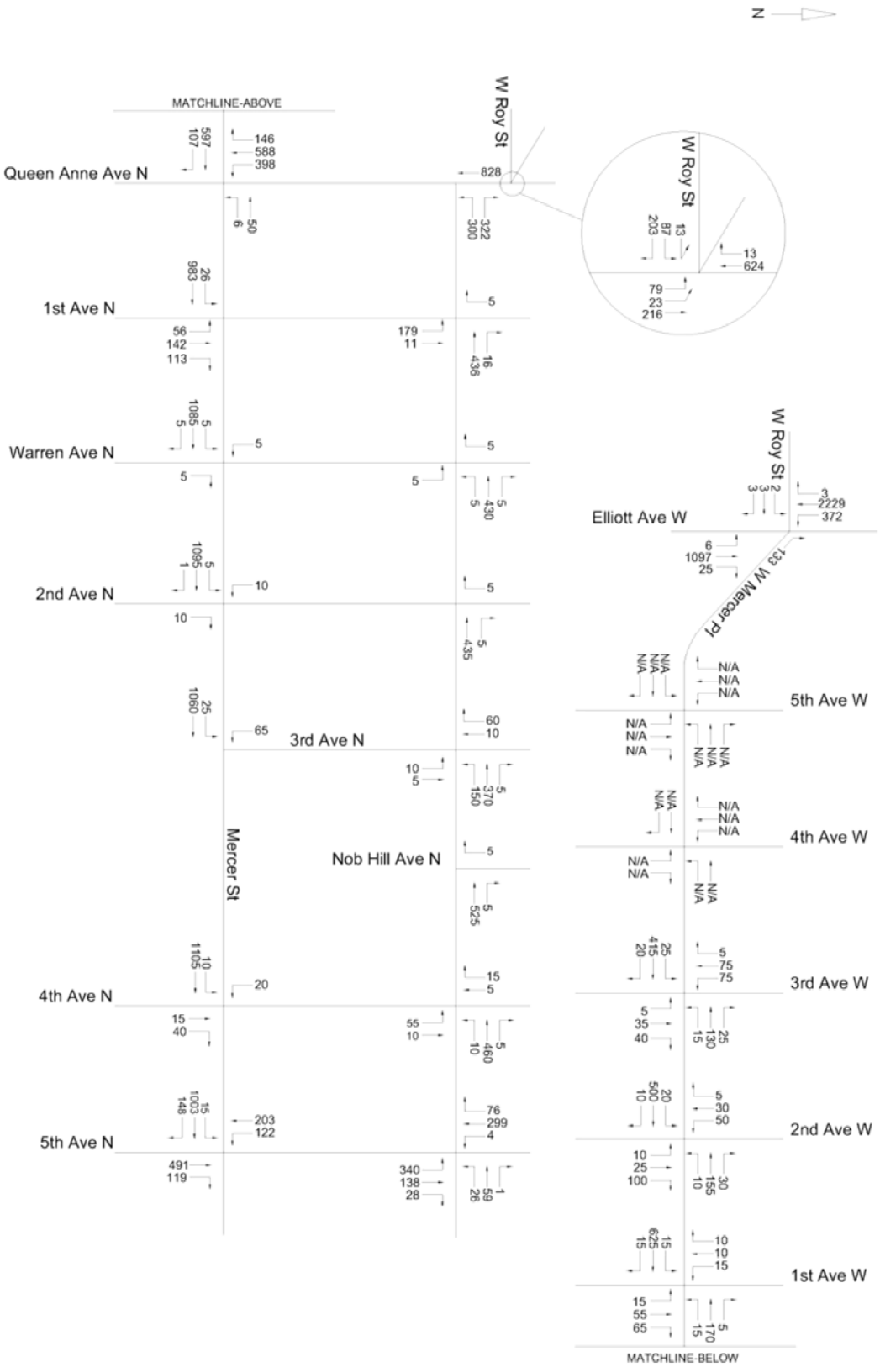


Exhibit 4-2: Existing Condition Volumes (AM Peak Hour)
Source: DKS Associates, 2010

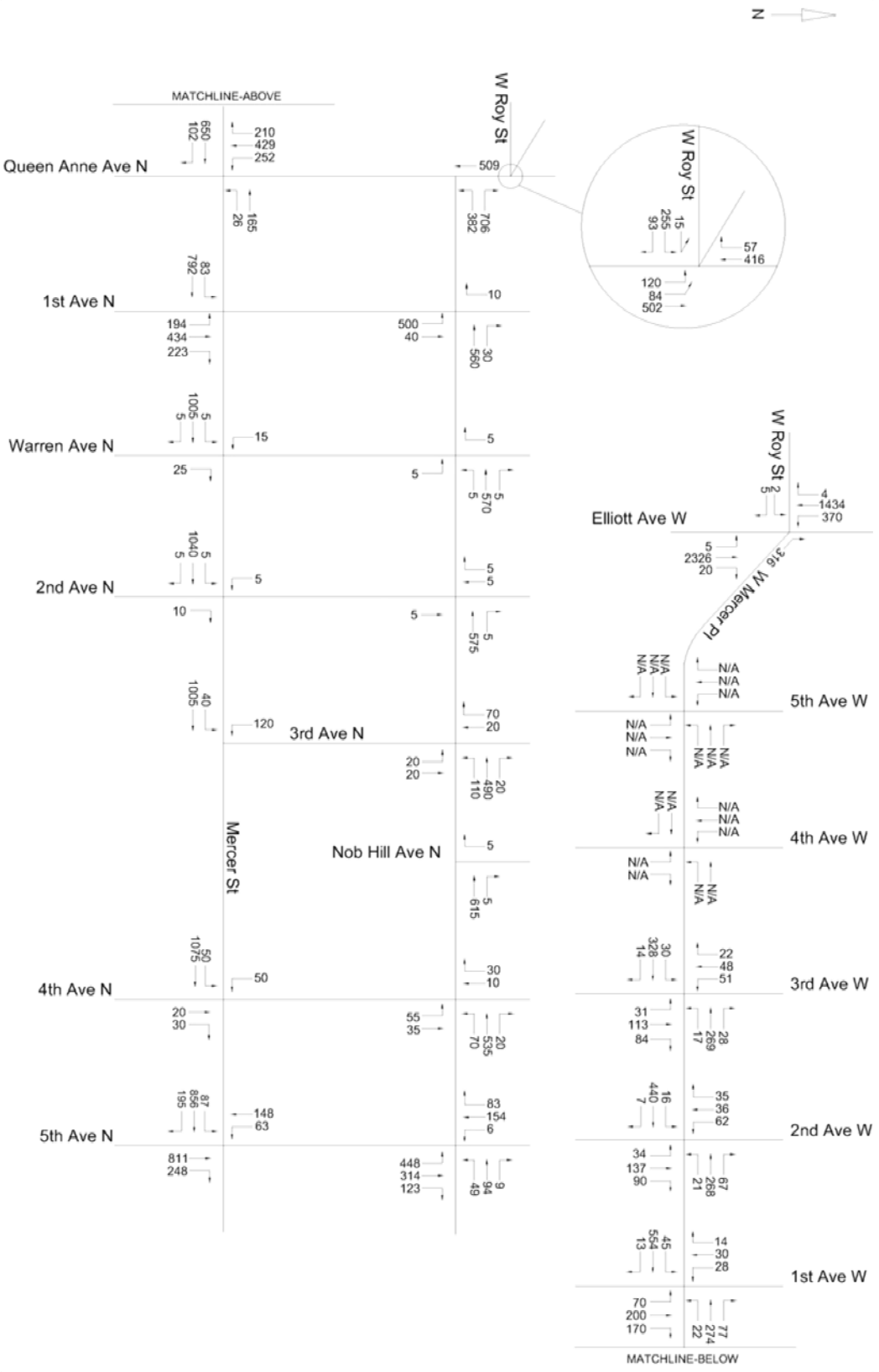


Exhibit 4-3: Existing Condition Volumes (PM Peak Hour)
Source: DKS Associates, 2010

Intersection Level of Service

For urban areas, traffic congestion on city streets is most significantly affected by intersection operations. The measures of effectiveness that will be utilized in this analysis include volume, delay and level-of-service (LOS).

LOS is a general measure of congestion for transportation facilities such as intersections, freeways, and arterials. Table 4-1 shows standardized LOS criteria and thresholds for signalized intersections, as given in the updated TRB 2000 Highway Capacity Manual.

Table 4-1: Level of Service Criteria

Signalized Intersections		
LOS	**Signalized Delay**	**Description**
A	≤10	Low delays, virtually free flow, unimpeded
B	> 10 and ≤ 20	Stable flow with minor delays, less freedom to maneuver through the intersection
C	> 20 and ≤ 35	Stable flow with some delays, less freedom to maneuver through the intersection
D	> 35 and ≤ 55	Long delays and high density, but stable flow and operations
E	> 55 and ≤ 80	Operating conditions at or near capacity
F	> 80	Forced operation, breakdown conditions
Two-Way Stop-Controlled Intersections		
LOS	**Control Delay (Side Street)**	**Description**
A	≤10	Low delays, virtually free flow, unimpeded
B	> 10 and ≤ 15	Stable flow with minor delays, occasional queues on side streets
C	> 15 and ≤ 25	Stable flow with some delays, some queues expected on side streets
D	> 25 and ≤ 35	Longer queue delays on side streets, waiting for through traffic
E	> 35 and ≤ 50	Operating conditions at or near capacity, significant queues on side streets
F	> 50	Significant queuing and delay on side streets
All-Way Stop-Controlled Intersections		
LOS	**Control Delay (All Approaches)**	**Description**
A	≤10	Low delays, virtually free flow, unimpeded
B	> 10 and ≤ 20	Stable flow with minor delays, occasional queues on side streets
C	> 20 and ≤ 35	Stable flow with some delays, some queues expected on side streets
D	> 35 and ≤ 55	Longer queue delays on side streets, waiting for through traffic
E	> 55 and ≤ 80	Operating conditions at or near capacity, significant queues on side streets
F	> 80	Significant queuing and delay on side streets

Delay reported as seconds per vehicle.

Source: Transportation Research Board, *Highway Capacity Manual* 2000 (Chapters 16 and 17).

To determine delay and LOS, specialized software tools are available. The software tool used for the intersection operational analysis in the study area is Synchro.

Synchro is macroscopic traffic simulation software that allows for the delay and LOS to be determined based upon the existing conditions traffic operations at studied intersections. This includes intersection geometrics, signal timing and phasing and resulting traffic volumes. The existing conditions analysis was conducted for the studied intersections for both AM and PM peak hour periods.

The existing conditions roadway network was developed from information collected from field reviews, aerial photographs and data provided by the City of Seattle and the AWV project team. Operational analysis of existing AM and PM peak-hour conditions were performed for each studied intersection along Mercer Street and Roy Street using Synchro to determine intersection delay and associated LOS. AM and PM analysis results are shown in Exhibit 4-4 and Exhibit 4-5 respectively.

Under AM peak-hour conditions, most intersections operated at LOS C or better. Only one intersection, Mercer Street and Queen Anne Avenue North, operated at LOS D because of high traffic volume demand at the southbound and eastbound approaches, resulting in long delays.

Under PM peak-hour conditions, most intersections operated at LOS C or better. Only one intersection operated at LOS D. The Roy Street and Fifth Avenue North intersection operates at LOS D due to high traffic volume demand at the northbound approach.

Exhibit 4-4: Existing 2010 Condition Traffic Operations (AM Peak Hour)
Source: DKS Associates, 2010

Exhibit 4-5: Existing 2010 Condition Traffic Operations (PM Peak Hour)
Source: DKS Associates, 2010

Transit Routes and Service

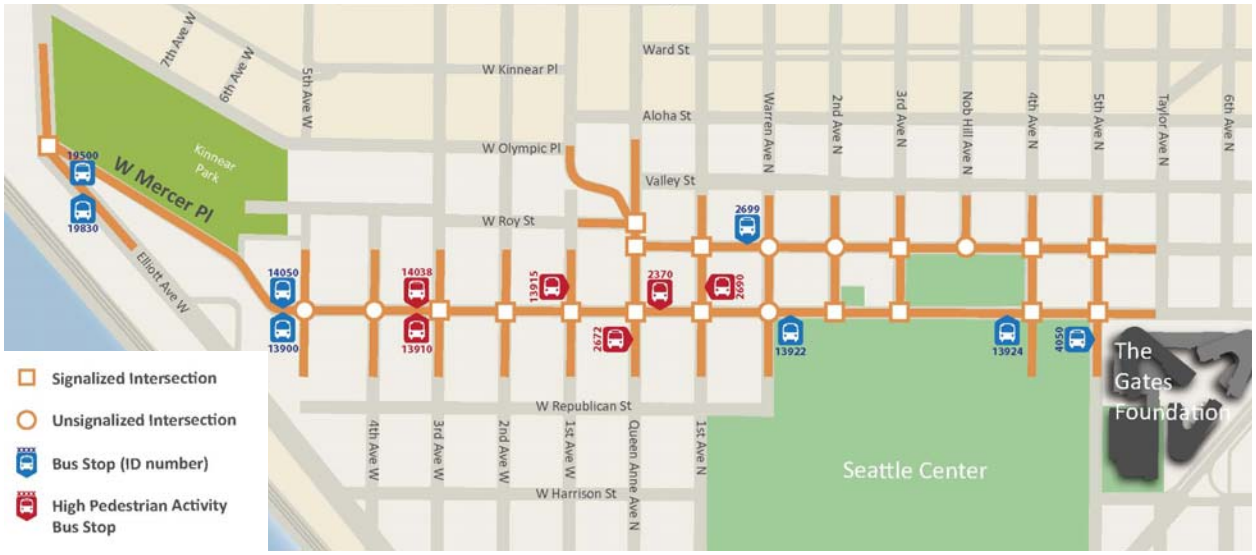
As a corridor within the City of Seattle, the study area carries many transit routes. This service is operated by King County Department of Transportation Metro Transit division or King County Metro. The transit routes operated by King County Metro in the study area are listed in Table 4-2.

Table 4-2: Transit Route Destination Summary

Route Number	Route Destinations
Route 1	Downtown/Kinnear
Route 2	Downtown/ Madrona Park/ Queen Anne
Route 3/4	Downtown/ Madrona Park/ Judkins Park/ Queen Anne Hill
Route 8	Seattle Center/ Capitol Hill/ Rainier Beach
Route 13	Downtown/ Seattle Pacific University
Route 15/ 18	Downtown/ Ballard/ Blue Ridge/ North Beach
Route 16	Downtown/ Northgate Transit Center
Route 19/24	Downtown/ Magnolia
Route 30	Seattle Center/ University District/ San Point
Route 33	Downtown/ Discovery Park
Route 45	Queen Anne/ University District
Route 81	Ballard/ Loyal Heights (Night Owl)
Route 82	Queen Anne/ Green Lake/ Greenwood (Night Owl)
Route 994	Downtown/ Lakeside Schools

Source: King County Metro

These bus routes stop at locations in the project study area. Each bus stop is included in an inventory maintained by King County Metro. The bus stop number and the routes that stop at these locations are shown in Exhibit 4-6. The bus stops with the highest activity are shown in red on this exhibit; the remaining stops are shown in blue.



Bus Stop ID	Location	Routes Served
19500	NB On Elliott Ave W/NS W Mercer	19, 24, 33
19830	SB On Elliott Ave N/FM W Roy St	19, 24, 33
14050	WB On W Mercer/FS Fifth Ave W	15, 18, 81
13900	EB On W Mercer/NS Fifth Ave W	15, 18, 81
14038	WB On W Mercer/FS Third Ave W	15, 18, 81
13910	EB On W Mercer/NS Third Ave W	15, 18, 81
13915	SB On First Ave W/NS W Mercer	8
2672	SB On Queen Anne Ave N/FS W Mercer	1, 2, 8, 13, 15, 18, 81, 994
2370	WB On W Mercer/NS Queen Anne Ave N	1, 8, 15, 18, 81, 994
2690	NB On First Ave N/FS W Mercer	2, 13
2699	WB On Roy St/FS Warren Ave N	45
13922	EB On W Mercer/FS Warren Ave N	30, 45
13924	EB On W Mercer/NS Fourth Ave N	30, 45
4050	SB On Fifth Ave N/FM W Mercer	3, 4, 16, 82

Exhibit 4-6: Existing Transit Stop Locations and Routes Served
Source: King County Metro, 2010

A summary of the frequency of weekday bus activity at peak hours by route is also provided in Table 4-3. Some routes operate in only one-direction at peak hour. Routes 81 and 82 operate only as "owl" service in the early morning hours of the day.

Table 4-3: Transit Route Frequency

Route		Street	Buses per Hour	
No.	Destination	Segment Used	AM Peak Hour	PM Peak Hour
1	To Kinnear	W Mercer St: First Ave N to Second Ave W	4	4
1	To Downtown	Queen Anne Ave N: W Roy St to W Republican St	3	4
2	To Queen Anne	First Ave N: W Republican St to W Roy St; W Roy St: First Ave N to Queen Anne Ave N	4	8
2	To Downtown/ Madrona	Queen Anne Ave N: W Roy St to W Republican St	11	5
3/ 4	To Queen Anne	Fifth Ave N: W Republican to W Roy St	8	6
3/ 4	To Downtown/ Madrona	Fifth Ave N: W Roy St to W Republican St	6	6
8	To Seattle Center	First Ave N: W Republican St to W Mercer St; W Mercer St: First Ave N to Second Ave W	5	4
8	To Capitol Hill/ Ranier Beach	W Mercer St: First Ave W to Queen Anne Ave; Queen Anne Ave W: Mercer St to W Republican St	4	4
13	To Seattle Pacific University	First Ave N: W Republican St to W Roy St; W Roy St: First Ave N to Queen Anne Ave N	4	4
13	To Downtown	Queen Anne Ave N: W Roy St to W Republican St	4	4
15/ 18	To Ballard/ Blue Ridge/ North Beach	First Ave N: W Republican St to W Mercer St; W Mercer St: First Ave N to Elliott Ave	4	4
15/ 18	To Downtown	Mercer St: Elliott Ave W to Quuen Anne Ave N; Queen Anne Ave N: W Mercer St to W Republican St	6	3
30	To University District/ Sand Point	First Ave N: W Republican St to W Mercer St; W Mercer St: First Ave N to Dexter Ave N	2	2
45	To Queen Anne	Queen Anne Ave N: W Roy St to W Mercer St; W Mercer St: Queen Anne Ave N to Fourth Ave N	2	0
45	To University District	W Roy St: Warren Ave N to Queen Anne Ave N	0	2
81	To Ballard/ Loyal Heights (owl)	First Ave N: W Republican St to W Mercer St; W Mercer St: First Ave N to Elliott Ave	0	0
82	To Greenlake	Fifth Ave N: W Republican to W Roy St	0	0
994	To Lakeside	First Ave N: W Republican St to W Mercer St; W Mercer St: First Ave N to Elliott Ave	1	0
994	To Downtown	Mercer St: Elliott Ave W to Quuen Anne Ave N; Queen Anne Ave N: W Roy St to W Republican St	0	1

Source: King County Metro 2010

Parking Inventory

Within the project study area, there is an active commercial district located between Second Avenue West and Third Avenue North. Many businesses in this area do not have off-street parking, which creates a demand for on-street parking within the area.

Exhibit 4-7 shows the on-street parking inventory by block face in the commercial district area. The exhibit shows the number of parking spots supplied on each side of the street. The number associated with the automobile icon indicates the number of standard vehicle parking spaces, while the truck icon represents the number of loading zones. Where there are no parking or loading zones, the number is shown in gray as zero.

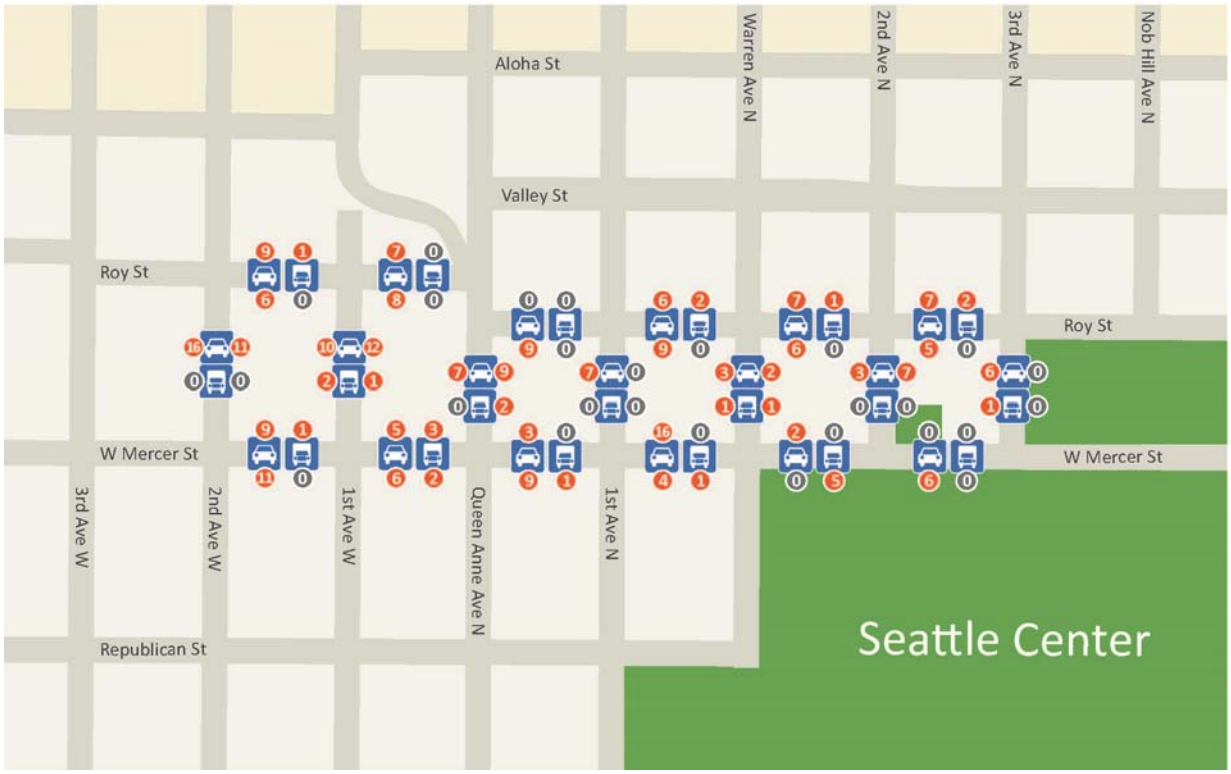


Exhibit 4-7: On-Street Parking Inventory
Source: DKS Associates field survey, 2010

Existing Bicycle Facilities

The study area features a number of street treatments for bicyclists. The existing bicycle treatments are identified in Table 4-4. The existing bicycle facility location and type are published in the 2010 Seattle Bicycling Guide Map.

Table 4-4: Existing Bicycle Facilities in the Study Area

Route	Extent	Direction	Bicycle Facility Type
Mercer St	From First Ave N to Warren Ave N	Eastbound	On street bike lane
Mercer St	From Warren Ave N to Second Ave N	Eastbound	Sharrow
Mercer St	From Second Ave N to Fifth Ave N	Eastbound	On street bike lane
Roy St	From Fifth Ave N to Queen Anne Ave N	Westbound	On street bike lane
Queen Anne Ave N	From Roy St to Mercer St	Southbound	Sharrow
First Ave N	From Mercer St to Roy St	Northbound	Sharrow
Third Ave W	From Mercer St to Roy St	Northbound	Un-marked, un-signed arterial street connection

Source: Seattle Bicycling Guide Map, City of Seattle Department of Transportation, 2010

Pedestrian Access

Within the study area, there is pedestrian activity associated with the active commercial district and the events at the Seattle Center. Table 4-5 highlights the observed total intersection pedestrian volume at key intersections in the study area during the AM and PM peak, as well as in pre-event and post-event conditions. The event data was collected for the Seattle Storm WNBA Finals basketball game on Wednesday, September 14, 2010 taking place at the Seattle Center. The AM and PM peak hour data was collected on September 15, 2010.

Under normal AM and PM peak hour conditions, total intersection pedestrian volumes are highest on Mercer Street at Queen Anne Avenue North and at First Avenue North. Both intersections have high pedestrian volumes during the AM and the PM peak periods, though the PM peak volumes are more than double the AM peak pedestrian volumes. Other study intersections with high AM and PM pedestrian volumes include Mercer Street and Fifth Avenue North, Roy Street and Queen Anne Avenue North, and Roy Street and Fifth Avenue North intersections.

Before and after a Seattle Center event, the pedestrian volumes notably increase. Preceding the WNBA Finals event, the pedestrian volume at Mercer Street and Queen Anne Avenue North was 1143, an increase of 488 pedestrians over the normal PM peak hour volume. As seen in Table 4-5, the pedestrian volumes are greatest near the Seattle Center and decrease as the intersections get further and further away with the smallest volume at Mercer Street and Third Avenue West.

Table 4-5: Comparison of Total Intersection Pedestrian Volume at Key Intersections

Intersection	AM Peak	PM Peak	Pre Event	Post Event
W Mercer Pl & Elliott Ave W	10	20	N/A	N/A
Mercer St & Third Ave W	N/A	N/A	274 (5:00pm-6:00pm)	164 (8:30pm-9:30pm)
Mercer St & Second Ave W	N/A	N/A	N/A	218 (8:30pm-9:30pm)
Mercer St & First Ave W	N/A	N/A	N/A	348 (8:30pm-9:30pm)
Mercer St & Queen Anne Ave N	288	655	1143 (5:00pm-6:00pm)	753 (8:45pm-9:45pm)
Mercer St & First Ave N	189	660	1205 (5:30pm-6:30pm)	1019 (8:30pm-9:30pm)
Mercer St & Second Ave N	N/A	N/A	N/A	561 (8:30pm-9:30pm)
Mercer St & Third Ave N	N/A	N/A	N/A	507 (8:30pm-9:30pm)
Mercer St & Fourth Ave N	N/A	N/A	N/A	61 (9:30pm-10:30pm)
Mercer St & Fifth Ave N	190	289	445 (5:00pm-6:00pm)	328 (8:30pm-9:30pm)
Roy St & Queen Anne Ave N	133	272	N/A	N/A
Roy St & Fifth Ave N	116	167	N/A	N/A

Source: Pedestrian Counts collected in September, 2010

Collision Analysis

Collision data along the study corridor was collected over a three year period, from January 1, 2007 through December 31, 2009. The six intersections with the highest occurrence of collisions and the four road segments with the highest occurrence of collisions are presented in Exhibit 4-8.

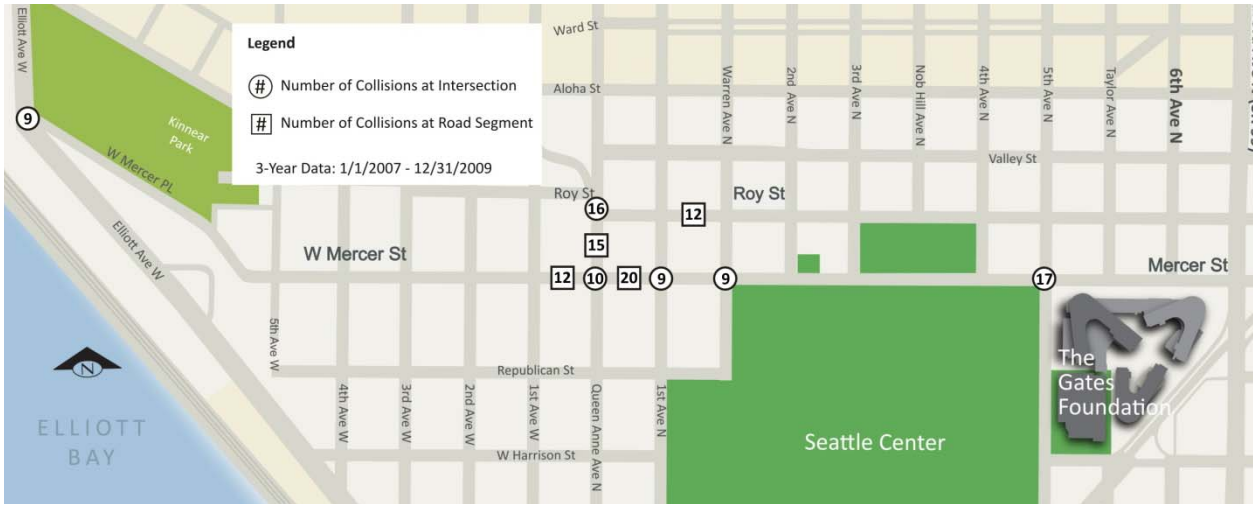


Exhibit 4-8: High Collision Intersection and Road Segment Locations

Source: SDOT Collision Records – 1/1/2007 – 12/31/2009

The six intersections with the highest occurrence of collisions are listed in Table 4-6. In the table, collisions are classified as either property damage only (PDO) or injury (INJ); there were no reported fatal collisions in the corridor. The last ten columns indicate the type of collision (the abbreviations are defined below the table).

Table 4-6: Study Intersections with Highest Number of Collisions

Intersection Location	Collision Count			Collision Type									
	TOT	PDO	INJ	HDO	ANG	RE	SS	PCY	PED	RT	LT	PK	OTH
Mercer St & Fifth Ave North	17	12	3	0	3	0	4	0	0	0	8	0	0
Roy St & Queen Anne Ave N	16	11	5	0	6	2	4	0	4	0	0	0	0
Mercer St & Queen Anne Ave N	10	6	3	0	2	0	2	1	1	0	2	1	0
W Mercer Pl & Elliott Ave W	9	5	4	0	0	1	1	0	0	1	4	0	2
Mercer St & First Ave N	9	3	4	0	1	0	2	0	4	0	0	0	0
Mercer St & Warren Ave N	9	3	6	0	1	1	1	1	4	0	1	0	0

TOT: Total # of Collisions PDO: Total # of Property Damage Only Collisions INJ: Total # of Injury Collisions
HDO: Head-on Collision ANG: Right Angle RE: Rear End
SS: Sideswipe PCY: Pedalcyclist PED: Pedestrian
RT: Right Turn LT: Left Turn PK: Parked Car
OTH: Other

Source: SDOT Collision Records – 1/1/2007 – 12/31/2009

The intersection with the highest number of collisions is Fifth Avenue North and Mercer Street with 17 total collisions. Twelve of those collisions were property damage only and only three resulted in injuries. The most common type of collision at Fifth Avenue North and Mercer Street, totaling eight of the 17 collisions, are collisions involving left turning vehicles.

At Queen Anne Avenue North and Roy Street, there were 16 collisions, 11 of which were property damage only and five resulted in injuries. Right angle collisions were the most common collision type, representing six of the 16 collisions. In addition, four collisions were side swipes and another four involved pedestrians.

The adjacent intersection, Queen Anne Avenue North and Mercer Street had ten collisions, six of which were property damage only and three resulted in injuries. Several different types of collisions occurred at this intersection with nothing qualifying as the leading cause of the collision.

The next three intersections all had nine collisions. At Elliott Avenue West and West Mercer Place, five of the nine collisions were property damage only and four resulted in injuries. The most common type of collision, four of the nine, involved left turning vehicles. At First Avenue North and Mercer Street, three of the nine collisions were property damage only and four resulted in injuries. At Warren Avenue North and Mercer Street, three of the nine collisions were property damage only and six resulted in injuries. At both intersections, four of the nine collisions involved pedestrians.

The four road segments within the study corridor that have the highest occurrence of collisions are listed in Table 4-7. Similar to Table 4-6, the collision count and type are enumerated.

Table 4-7: Study Road Segments with Highest Number of Collisions

Segment	Collision Count			Collision Type									
	TOT	PDO	INJ	HDO	ANG	RE	SS	PCY	PED	RT	LT	PK	OTH
Mercer St between Queen Anne Ave N and First Ave N	20	13	7	0	0	13	4	0	1	0	1	1	0
Queen Anne Ave N between Roy St and Mercer St	15	14	1	0	0	6	2	0	0	0	0	5	2
Mercer St between Queen Anne Ave N and First Ave W	12	11	0	0	1	2	2	0	0	0	1	5	0
Roy St between Warren Ave N and First Ave N	12	9	2	0	2	2	1	0	0	0	0	4	2

TOT: Total # of Collisions PDO: Total # of Property Damage Only Collisions INJ: Total # of Injury Collisions
HDO: Head-on Collision ANG: Right Angle RE: Rear End
SS: Sideswipe PCY: Pedalcyclist PED: Pedestrian
RT: Right Turn LT: Left Turn PK: Parked Car
OTH: Other

Source: SDOT Collision Records – 1/1/2007 – 12/31/2009

The road segment with the highest number of collisions is on Mercer Street between Queen Anne Avenue North and First Avenue North with a total of 20 collisions. Thirteen of those collisions were property damage only and seven resulted in injuries. The most common type of collision in this segment was rear end collisions which accounted for 13 of the 20 collisions.

On Queen Anne Avenue North between Roy Street and Mercer Street, there were 15 recorded collisions, 14 of which were property damage only and only one resulted in an injury. On this road segment, the most common types of collision were rear end collisions with six of the 15 collisions and those involving a parked car with five of the 15.

Adjacent to both of the previously mentioned road segments, Mercer Street between Queen Anne Avenue North and First Avenue West had 12 total collisions, 11 of which were property damage only. There were several different types of collisions occurring on this road segment, but the most common type, five of the 12, involved a parked car.

Roy Street between Warren Avenue North and First Avenue North also had 12 total collisions, of which nine were property damage only and two involved injuries. Again, there were several different type of collisions on this road segment, but the most common type, four of the 12, involved a parked car.

Truck Traffic Analysis

Vehicle classification counts were conducted at three locations along the study corridor. Exhibit 4-8 and 4-9 respectively show the percentage of trucks and truck volume along the western end of the study corridor on West Mercer Place east of Elliott Avenue from 6 AM until 6 PM. As shown in Exhibit 4-8, the percentage of trucks on West Mercer Place varies throughout the day, from 1% to a maximum of 6%. The largest percentage of trucks occurs during the middle of the day, outside of the AM and PM peak periods. Exhibit 4-9 shows the truck volumes during the day. The different colored bars indicate the type

of truck, blue represents single unit trucks and green represents trailer trucks. The large majority of trucks in this section of the study area are single unit trucks.

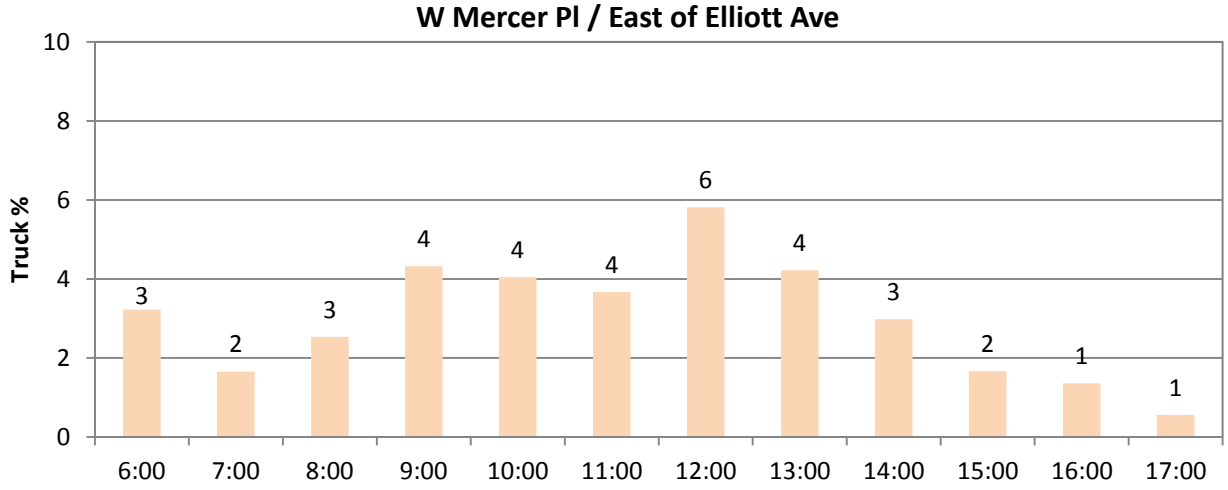


Exhibit 4-8: Truck Percentage on West Mercer Place, East of Elliott Avenue
Source: Truck Classification Survey, September, 2010

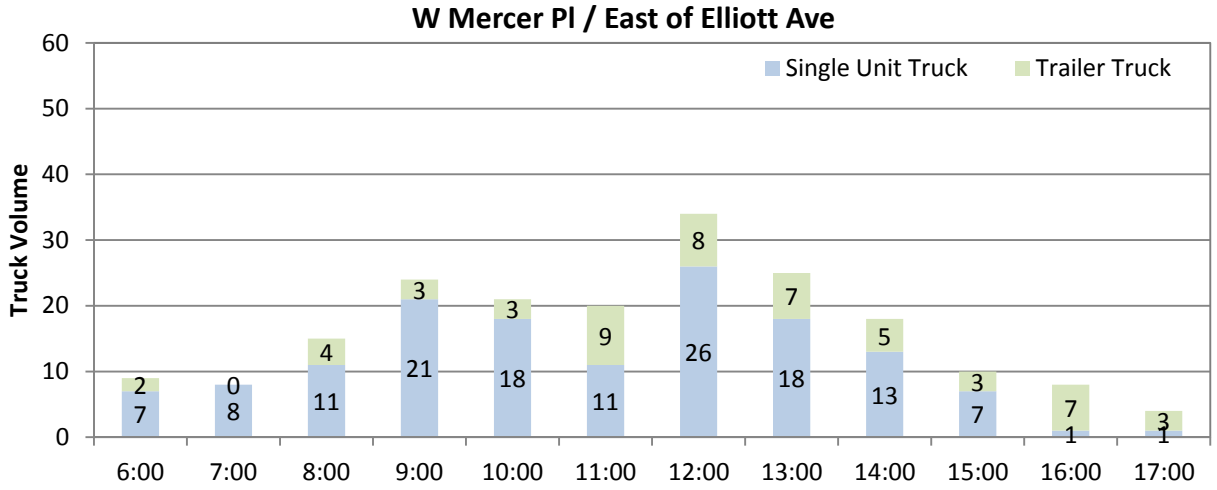


Exhibit 4-9: Truck Volumes on West Mercer Place, East of Elliott Avenue
Source: Truck Classification Survey, September, 2010

Truck volumes were also counted near the center of the corridor on Mercer Street, west of Queen Anne Avenue North. The truck percentage and volumes from 6 AM to 6 PM are shown in Exhibit 4-10 and Exhibit 4-11, respectively. The hourly truck percentage in this section of the study corridor has a similar profile to truck percentage shown in Exhibit 4-8 for the western portion of the study corridor. The values vary throughout the day, from 1% to 5%, with the higher values occurring during the middle of the day, outside of the AM and PM peak periods. As shown in Exhibit 4-11, the large majority of trucks in the segment of the corridor are single unit trucks. Single unit trucks are used for deliveries to business in the commercial district on Mercer Street.

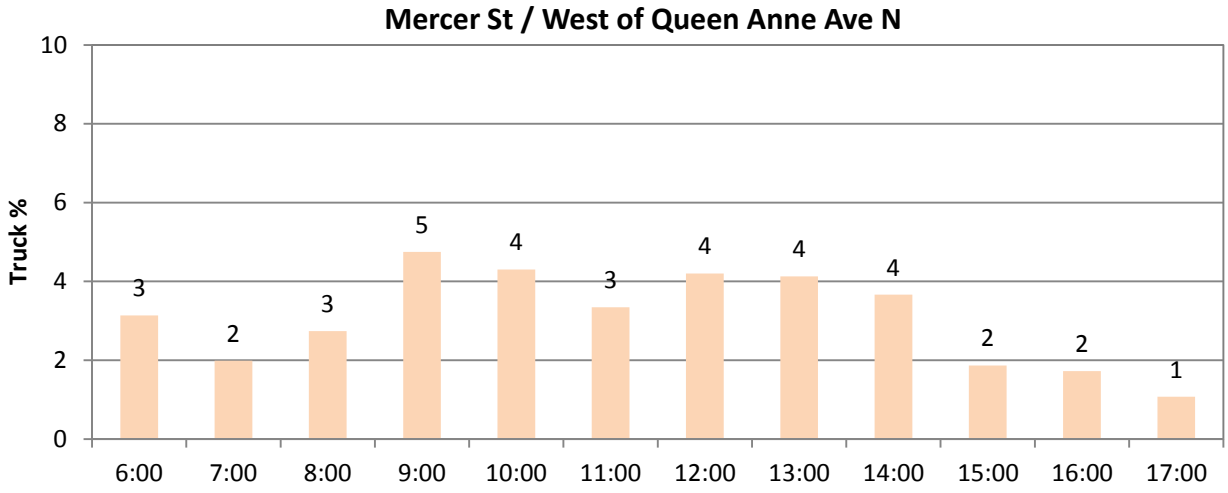


Exhibit 4-10: Truck Percentage on Mercer Street, West of Queen Anne Avenue North
Source: Truck Classification Survey, September, 2010

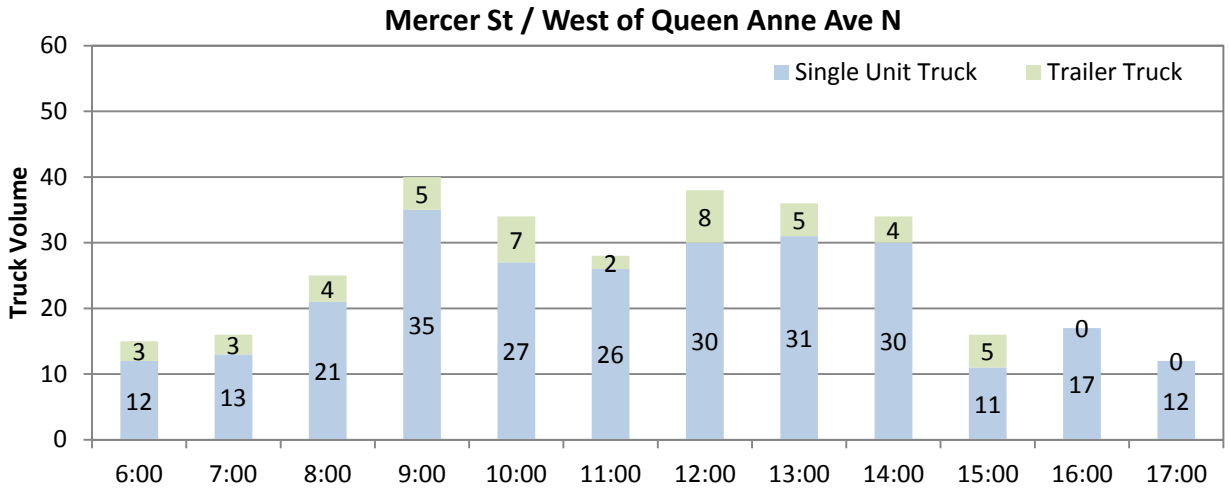


Exhibit 4-11: Truck Volumes on Mercer Street, West of Queen Anne Avenue North
Source: Truck Classification Survey, September, 2010

The third location of the truck counts was on the eastern end of the study corridor on Mercer Street, west of Third Avenue North. Exhibit 4-12 and Exhibit 4-13 show the truck percentage and volume, respectively, from 6 AM to 6 PM. This section of the study corridor can be characterized as similar to the center of the corridor as its truck percentages also vary between 1% and 5% with the higher percentages occurring midday and there being a majority of single unit trucks versus trailer trucks.

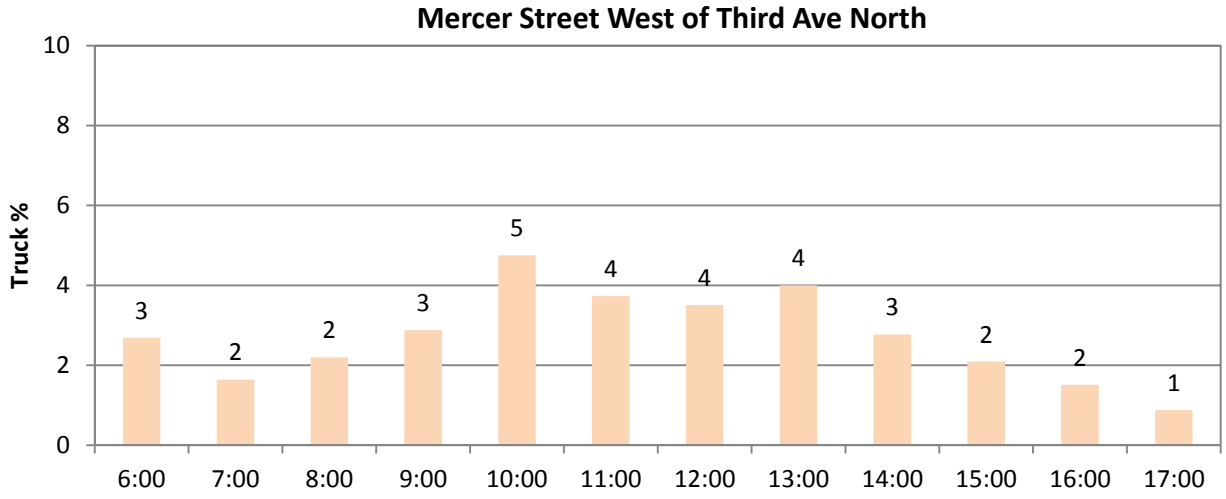


Exhibit 4-12: Truck Percentage on Mercer Street, West of Third Avenue North
Source: Truck Classification Survey, September, 2010

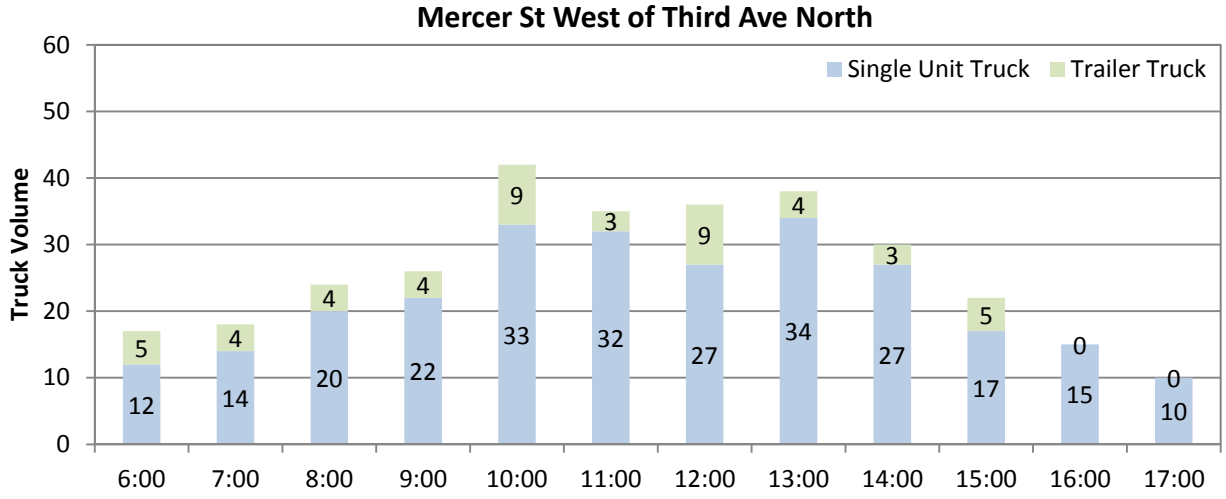


Exhibit 4-13: Truck Volumes on Mercer Street, West of Third Avenue North
Source: Truck Classification Survey, September, 2010

Seattle Center Event Traffic

A separate analysis of Seattle Center events was undertaken as part of the data collection. The purpose of this analysis is to identify how Seattle Center event traffic operates when compared to either the AM or the PM peak hours.

Pre-event and post-event traffic count data were collected for the Seattle Storm WNBA finals basketball game. The traffic operations before and after the event were also observed in the field. The pre-event traffic operation was similar to PM peak operation. During post-event traffic operation, the eastbound queue backed up from Fifth Avenue North to Second Avenue North along Mercer Street. The traffic speeds were quite low and operated under stop and go conditions during the peak post-event period.

Synchro models were used to analyze the pre and post event traffic operation. Table 4-8 presents the results of the analysis. The analysis results indicate that, the pre-event traffic did not vary significantly from a typical PM peak traffic. All intersections from Queen Anne Avenue North to Fifth Avenue North along the Mercer Street corridor operated at the same LOS (A to C) as in the PM peak period. However, during post-event traffic operation, the delays on Mercer Street increased significantly from Second Avenue North to Fifth Avenue North with the signalized intersections operating at LOS F.

Table 4-8 Comparison of Intersection Level of Service and Delay at Key Intersections

Intersection	AM Peak	PM Peak	Pre-Event	Post-Event
Mercer St & Queen Anne Ave N	D (50.2)	B (10.5)	B (16.1)	B (12.7)
Mercer St & First Ave N	C (20.3)	C (20.3)	C (20.5)	C (24.2)
Mercer St & Second Ave N	A (2.3)	A (1.7)	A (1.0)	F (138.8)
Mercer St & Third Ave N	B (13.3)	A (8.1)	A (8.1)	F (105.4)
Mercer St & Fourth Ave N	A (2.2)	B (13.3)	B (13.8)	F (93.6)
Mercer St & Fifth Ave N	B (13.4)	C (26.3)	C (28.3)	F (248.2)

Source: DKS Associates, 2010

Exhibit 4-14: Intersection Traffic Operations at Third Avenue North (Looking East at 9:20 pm)
Source: DKS Associates, 2010

CHAPTER 5
Environmental Consequences

This section discusses the effects of construction and operation of the Build Alternative and the No Build Alternative on transportation in the study area.

Traffic Operations

2015 Year of Opening Analysis

Turning-Movement Volumes

The analysis of traffic operations requires inputs of the various existing and proposed street geometries, specific traffic control details such as signal timing and phasing, and forecasts of traffic flow. The forecasts of traffic flow were developed for 2015 in the form of peak hour turning-movement volumes. The forecasted 2015 AM and PM peak hour turning-movement volumes for the 2015 No Build and Build scenarios are shown in Exhibit 5-1, Exhibit 5-2, Exhibit 5-3, and Exhibit 5-4, respectively. The No Build turning-movement forecasts reflect areawide traffic flow changes that are anticipated with the completion of the AWV project and its associated influence on travel patterns in the immediate area. The Build forecasts show the anticipated flows when the project condition is completed and operating, especially the new flows created when two-way traffic is introduced on Mercer Street, Roy Street, Queen Anne Avenue North and First Avenue North.

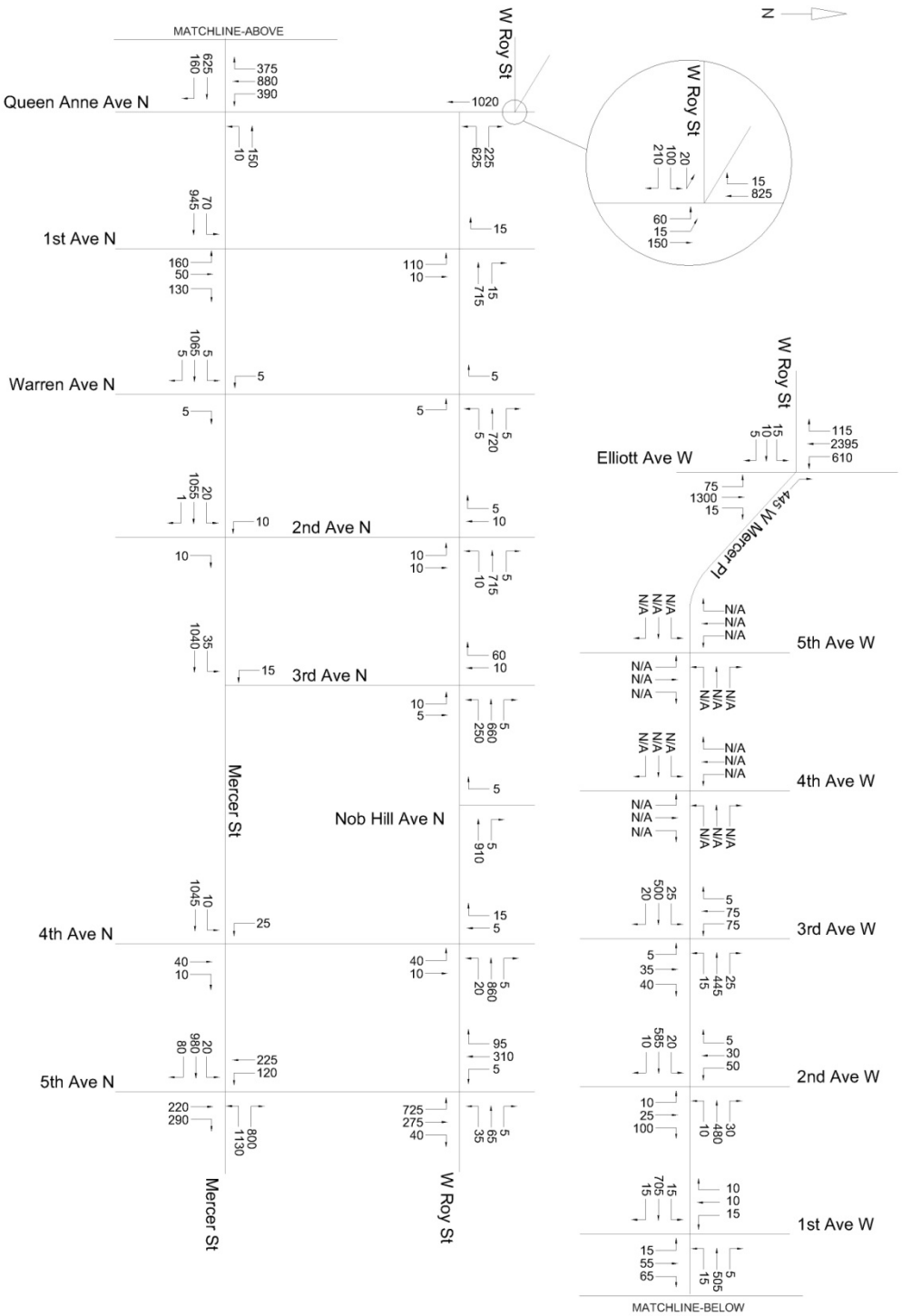


Exhibit 5-1: 2015 No Build Volumes (AM)

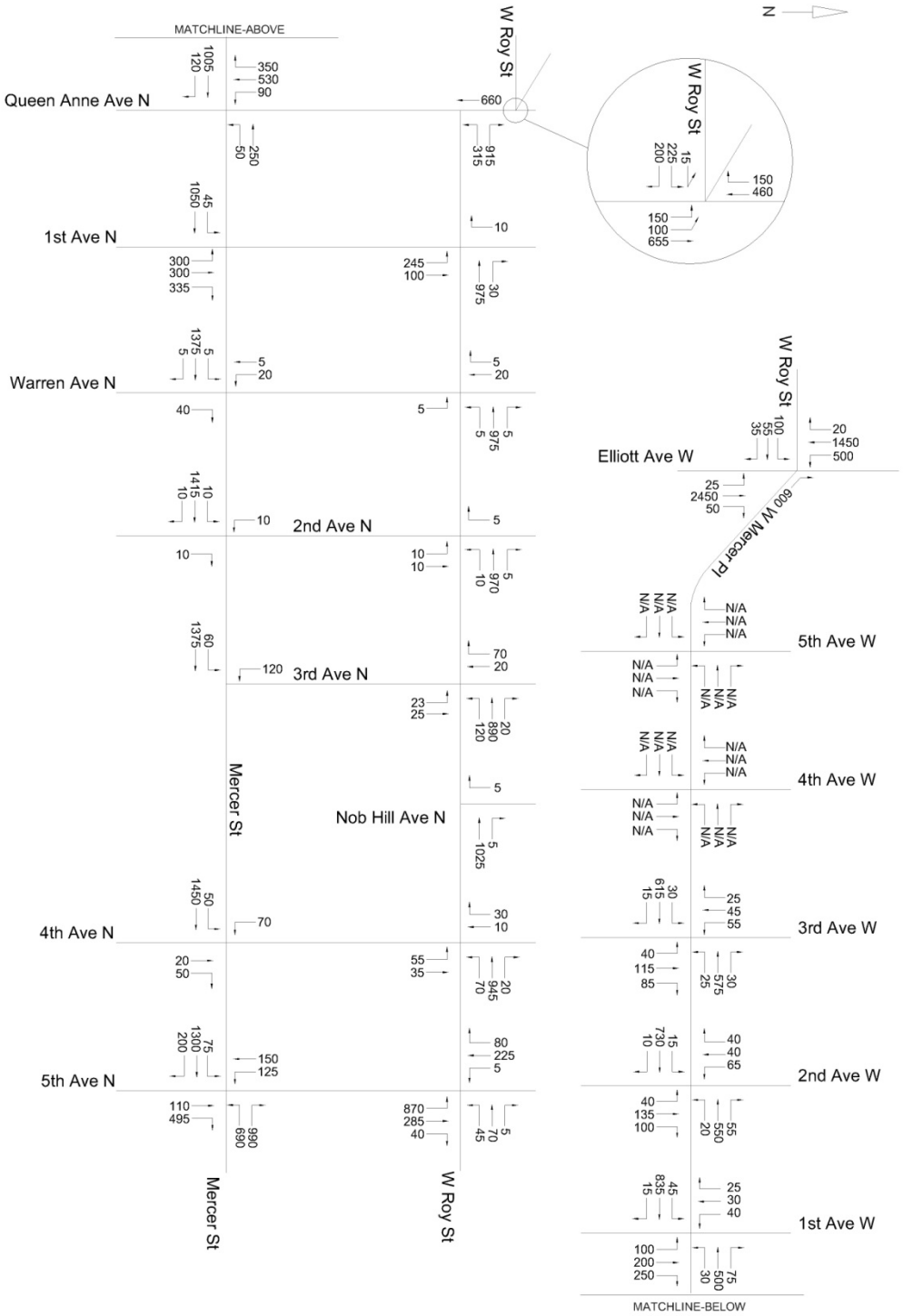


Exhibit 5-2: 2015 No Build Volumes (PM)

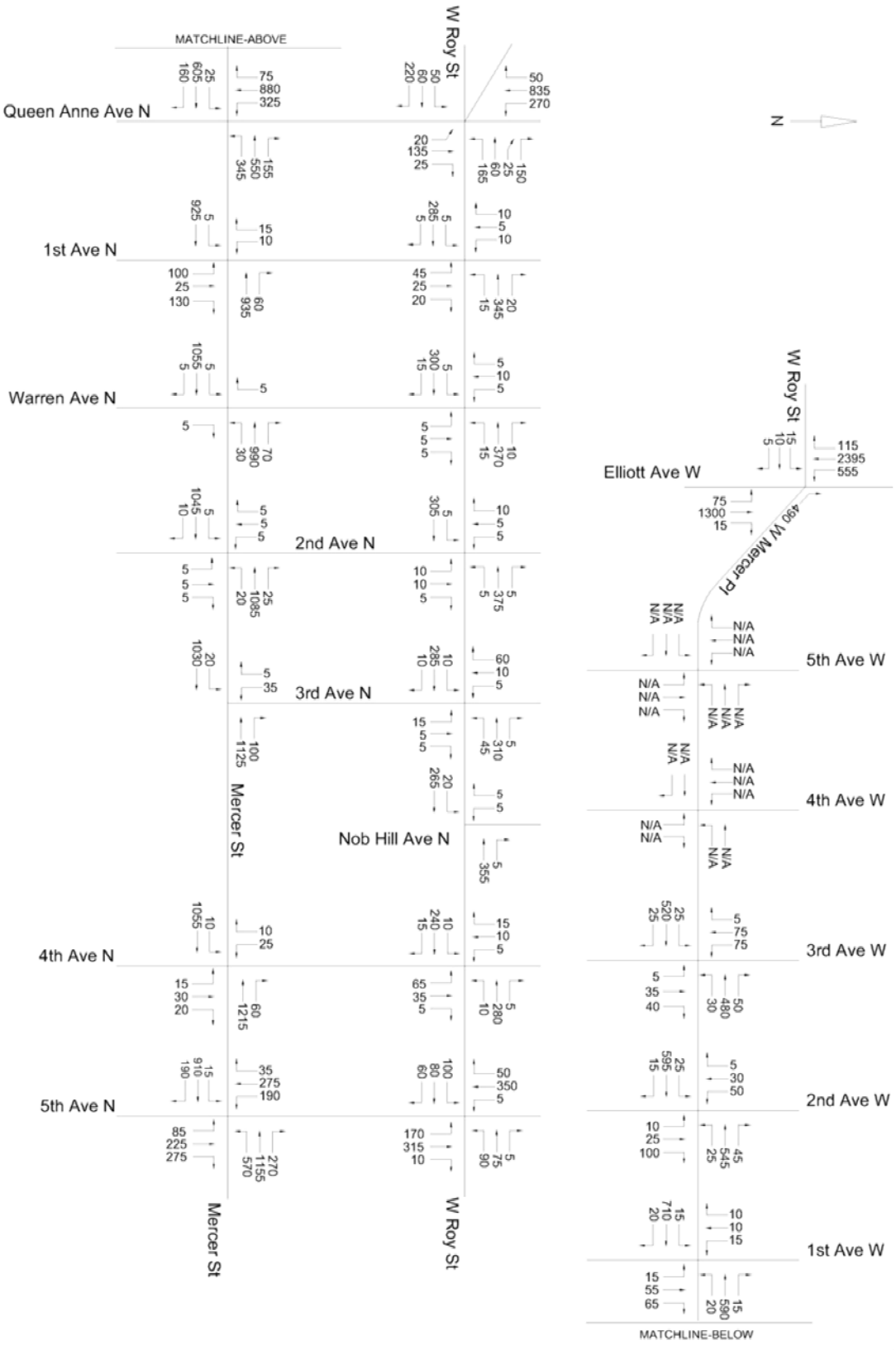


Exhibit 5-3: 2015 Build Volumes (AM)

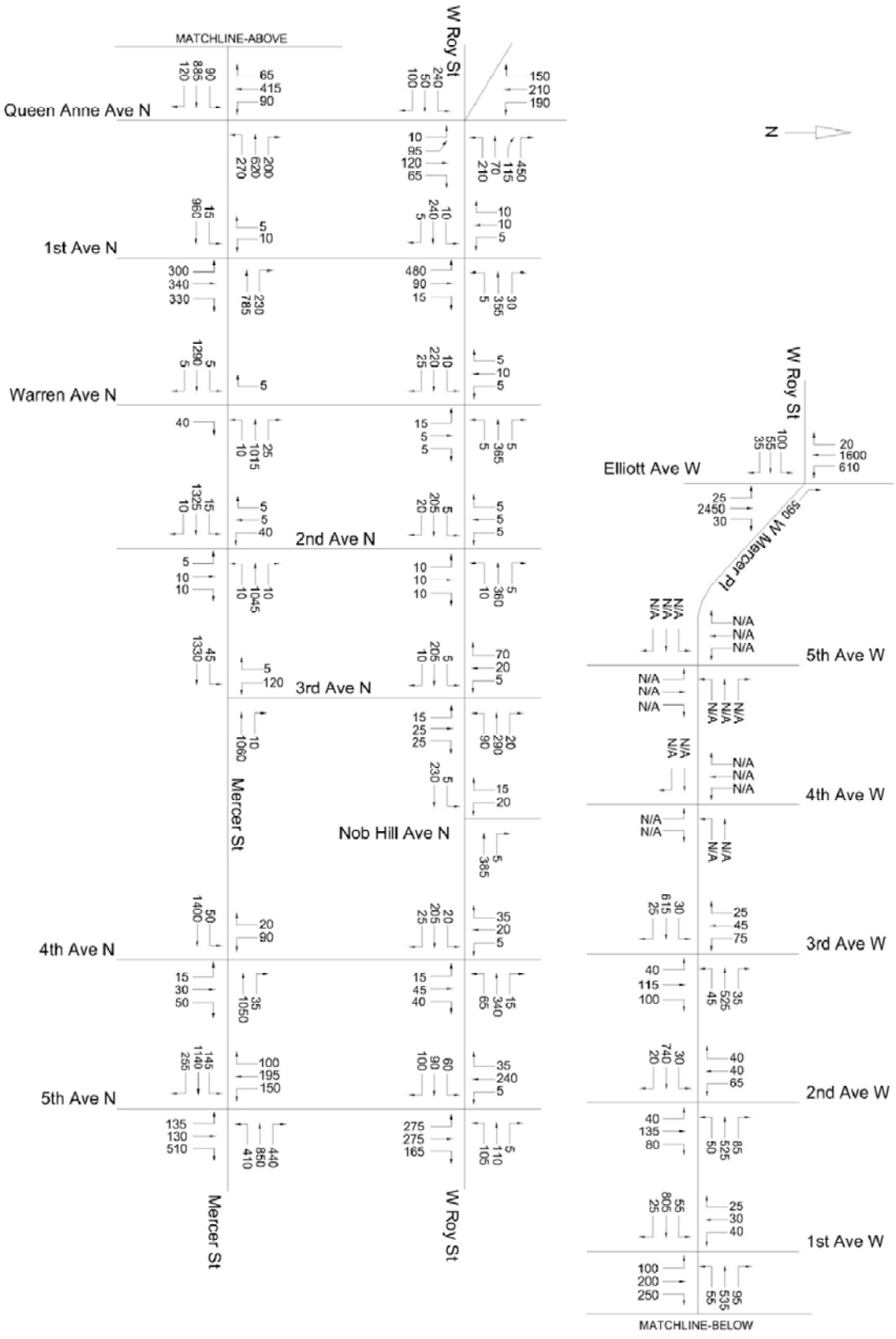


Exhibit 5-4: 2015 Build Volumes (PM)

Intersection Level of Service

Operational analysis of 2015 year of opening AM and PM peak hour No Build and Build conditions were performed for each intersection in the study area using Synchro for LOS and average signalized intersection delay. LOS results for each time scenario are shown in Exhibit 5-5, Exhibit 5-6, Exhibit 5-7, and Exhibit 5-8. Intersections experiencing LOS D or worse in the existing condition or any of the 2015 scenarios are listed in Table 5-1.

Table 5-1: Comparison of Critical Intersection Delays and LOS (2015)

	2010 Existing Condition		2015 No Build		2015 Build	
	AM	PM	AM	PM	AM	PM
W Mercer Pl & Elliott Ave	C (30.7)	C (33.3)	F (102.6)	F (108.8)	F (103.3)	F (149.4)
Mercer St & Queen Anne Ave N	D (50.2)	B (10.5)	C (25.4)	B (11.2)	E (59.2)	B (19.2)
Mercer St & Fifth Ave N	B (13.4)	C (26.3)	E (57.3)	F(80.6)	D (41.7)	E (77.5)
Roy St & Queen Anne Ave N	C (20.1)	C (23.6)	C (21.4)	B (15.2)	D (50.8)	E (76.8)
Roy St & First Ave N	A (8.3)	B (14.5)	A (7.4)	B (11.5)	B (10.5)	D (42.9)
Roy St &Fifth Ave N	C (33.0)	D (41.2)	D (53.6)	D (44.8)	C (23.7)	C (21.8)

Under 2015 No Build conditions, the major projects completed outside of the study area have an effect on the traffic flow and LOS in the study area. In the 2015 No Build condition, Mercer Street has been converted to two-way operations east of the study corridor from Fifth Avenue North to I-5. This new traffic configuration creates new westbound traffic at Mercer Street and Fifth Avenue North. Under the 2015 No Build AM peak hour conditions, compared to the Existing AM conditions, due to the new traffic configuration, average signalized intersection delay is expected to increase at both Mercer Street and Fifth Avenue North and at Roy Street and Fifth Avenue North. At Mercer Street and Fifth Avenue North, the addition of westbound left- and right-turning vehicles and the additional signal phases cause the intersection to operate at LOS E in the AM peak and F in the PM peak. At Roy Street and Fifth Avenue North, the LOS degrades from LOS C to E, mainly due to the expected increase in volume of northbound left-turning vehicles originating from Mercer Street.

At Mercer Street and Queen Anne Avenue North, the LOS improves from LOS D to C as a result of signal timing and signal coordination improvements that are assumed to occur with the implementation of the AWV project. At West Mercer Place and Elliott Avenue, the LOS degrades from LOS C to F. This degradation in LOS is due to the expected increase in volume for the southbound left-turn movement, and a new development that is planned on the west leg of the intersection.

Comparing the 2015 No Build PM peak hour conditions to the Existing PM conditions, there were smaller changes in average signalized intersection delay, leading to fewer LOS differences. Similar to the AM scenarios, the Mercer Street and Fifth Avenue North intersection performed worse in the 2015 No Build PM conditions than in the Existing PM conditions due to the addition of heavy westbound turning volumes and the additional signal phases. The intersection LOS degraded from LOS C to LOS F. The PM peak LOS at the West Mercer Place and Elliott Avenue degraded from LOS C to F due to the increase in southbound left-turning vehicles and the increase in volume resulting from a new development on the west side of the intersection.

Under 2015 Build AM peak hour conditions, compared to 2015 No Build conditions, signalized intersection delay and LOS at most intersections in the study area will change as the travel patterns shift with the new two-way configurations on Mercer and Roy Streets. For example on Fifth Avenue North at both Mercer Street and Roy Street the LOS improved. At Fifth Avenue North and Mercer Street, the average signalized intersection delay decreased by approximately 16 seconds, causing the LOS to improve from LOS E to D. At Fifth Avenue North and Roy Street, the average signalized intersection delay decreased by approximately 30 seconds, causing the LOS to increase from LOS D to C. In the AM No Build scenario, Fifth Avenue North is where both Mercer and Roy Streets switch from two-way operations to a one-way couplet. The redistribution of vehicles associated with the continuous two-way operations on Mercer and Roy Streets helped improve these intersections.

However, not all intersections are projected to improve with the new two-way operations as described in the Build Alternative. On Queen Anne Avenue North at Mercer Street, the LOS degraded from LOS C to E due to the increased traffic volumes and the additional signal phases needed for two-way operation on both Mercer Street and Queen Anne Avenue. At the Queen Anne Avenue North and Roy Street intersection, the LOS degraded from LOS C to D. This change in LOS can be attributed to the addition of northbound traffic on Queen Anne Avenue North and the split phase operation of the intersection. Split phase operation was assumed to allow for all of the turning movements at this intersection.

Under 2015 Build PM peak hour conditions, compared to 2015 No Build conditions, LOS at the signalized intersections on Mercer Street remained unchanged or improved. On Roy Street the LOS at some intersections improved while others degraded. Fifth Avenue North improved from LOS D to C, while Queen Anne degraded from LOS B to E and 1st Avenue North degraded from LOS B to D. In the Build conditions, Queen Anne Avenue and 1st Avenue North are converted to 2-way operations at Roy Street. This change in operations adds additional volume and turning movements to these intersections and requires additional signal phases for the added left turn movements.

Exhibit 5-5: 2015 No Build Traffic Operations (AM)

Exhibit 5-6: 2015 No Build Traffic Operations (PM)

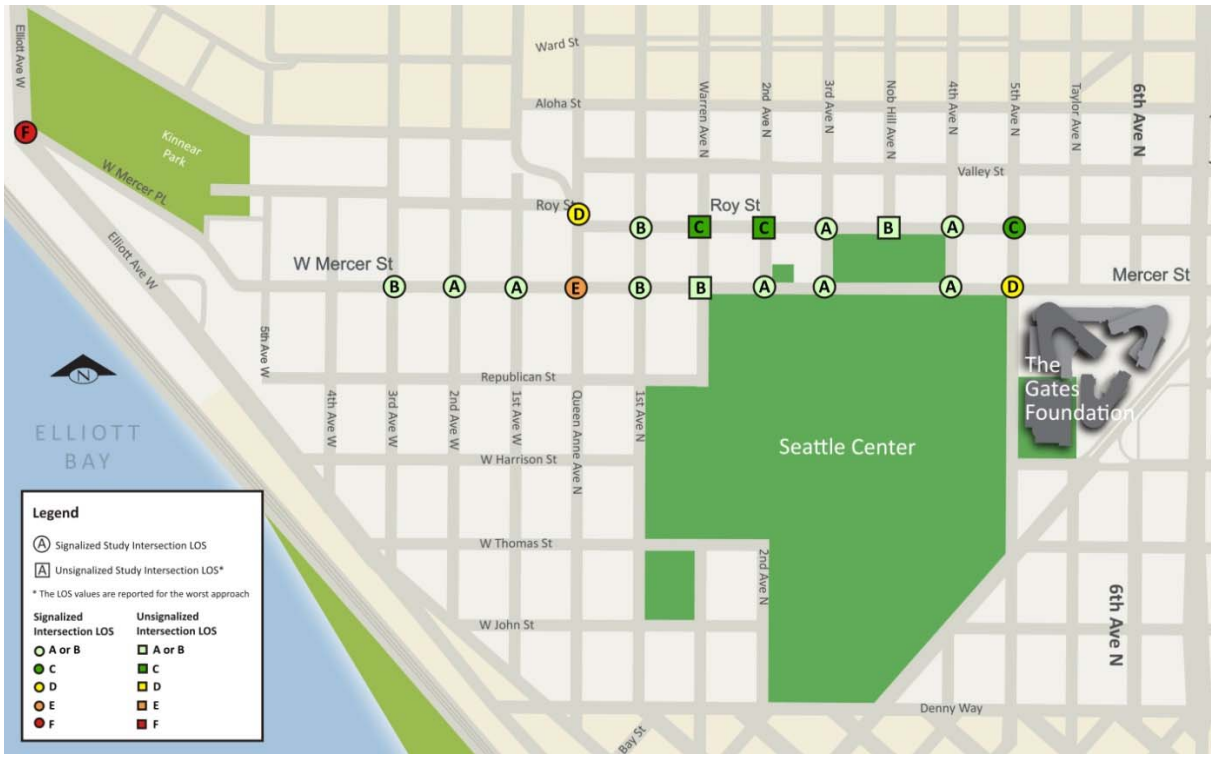


Exhibit 5-7: 2015 Build Traffic Operations (AM)

Exhibit 5-8: 2015 Build Traffic Operations (PM)

2030 Horizon Year Analysis

Turning-Movement Volumes

The AM and PM peak hour turning-movement volumes for the 2030 No Build and Build Alternatives were developed using the same methodology used for the 2015 forecasts. These 2030 volumes are shown in Exhibit 5-9, Exhibit 5-10, Exhibit 5-11, and Exhibit 5-12, respectively.

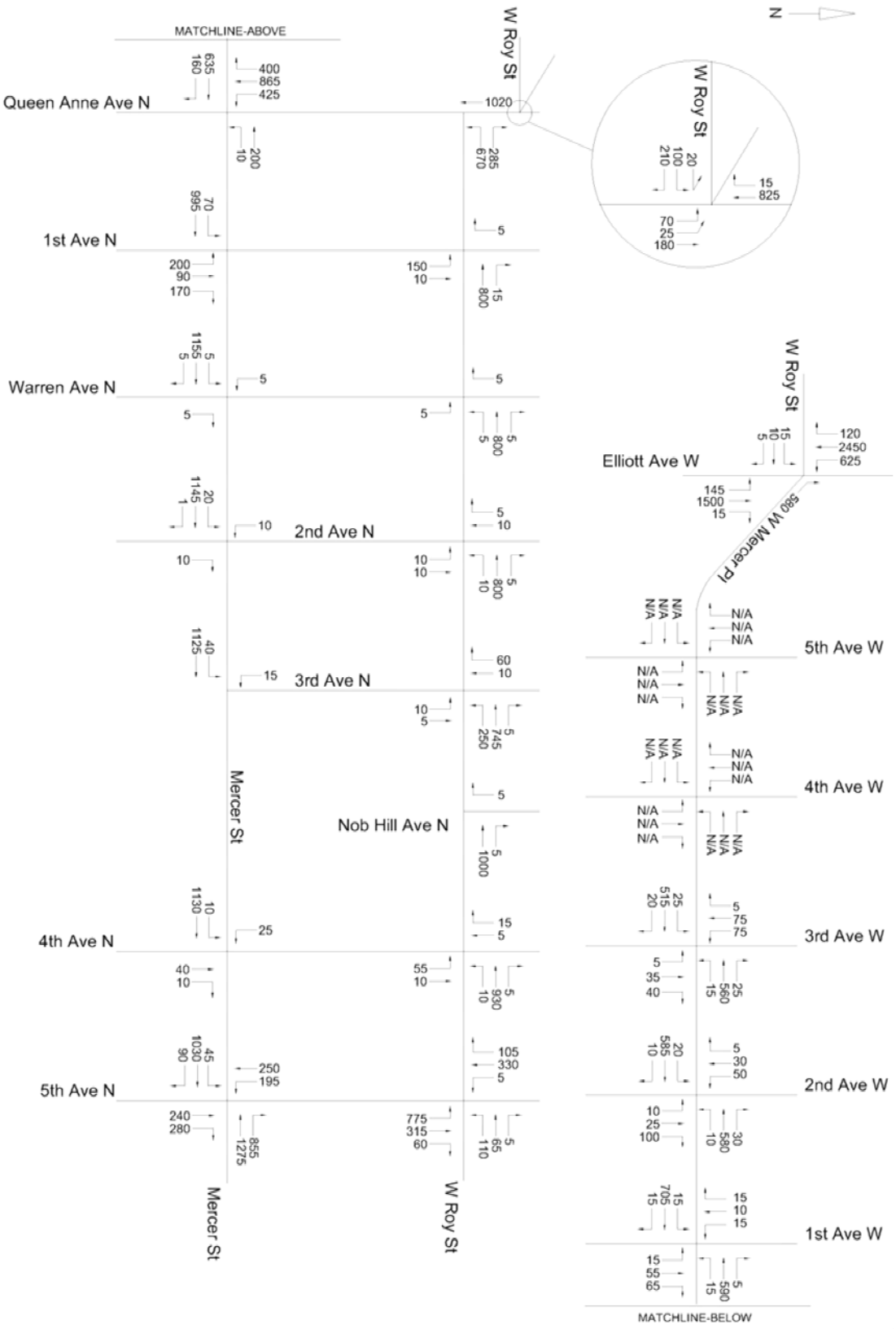


Exhibit 5-9: 2030 No Build Volumes (AM)

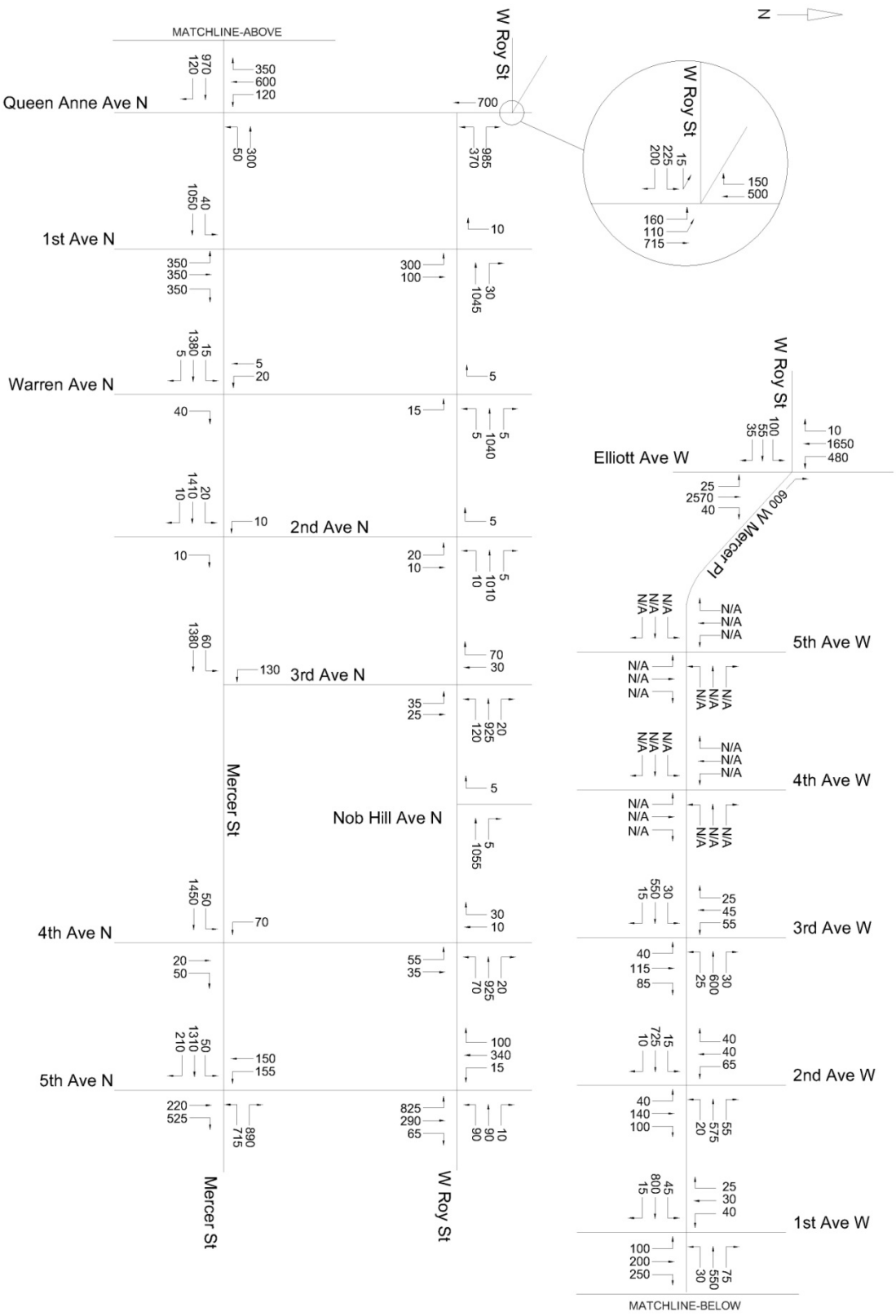


Exhibit 5-10: 2030 No Build Volumes (PM)

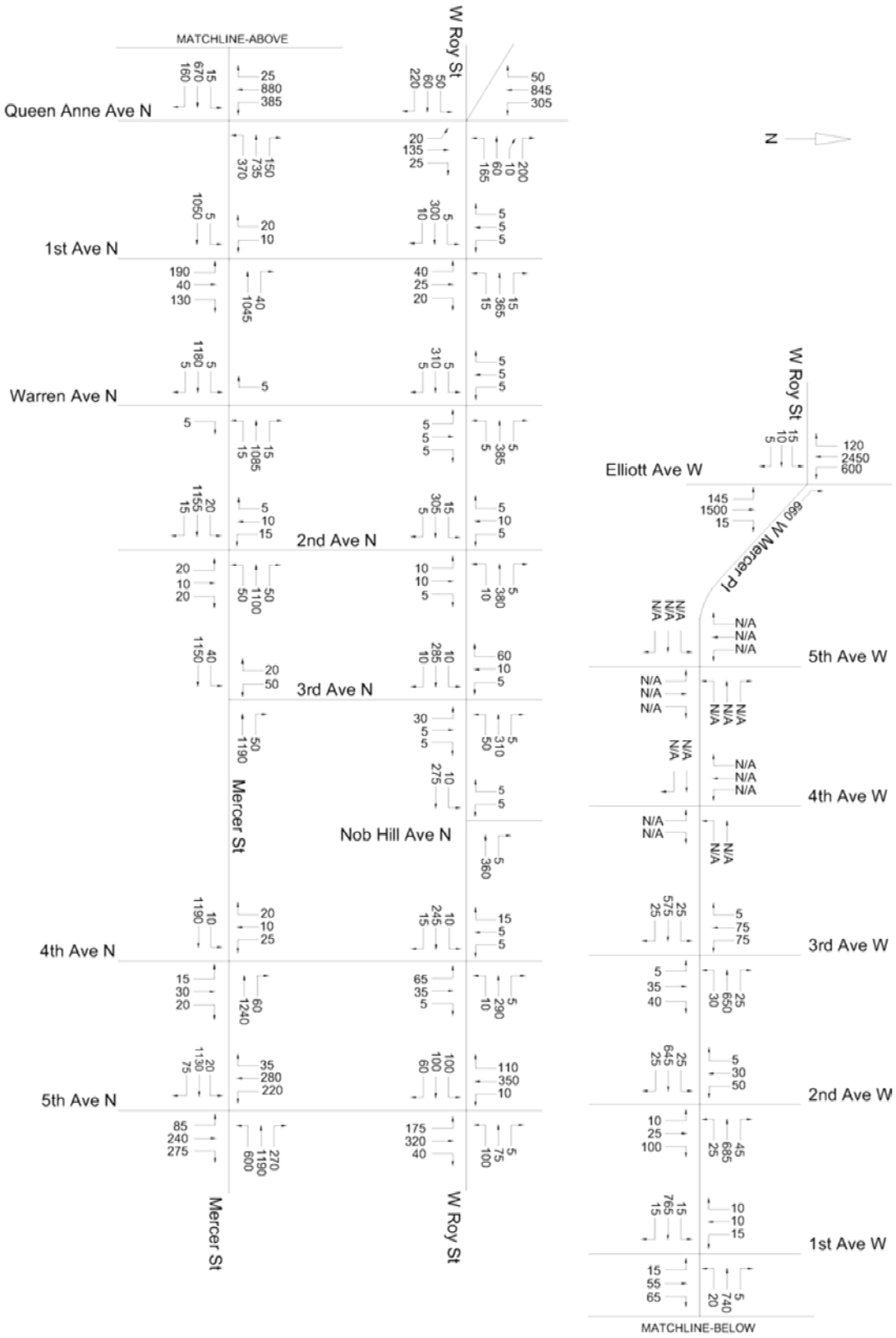


Exhibit 5-11: 2030 Build Volumes (AM)

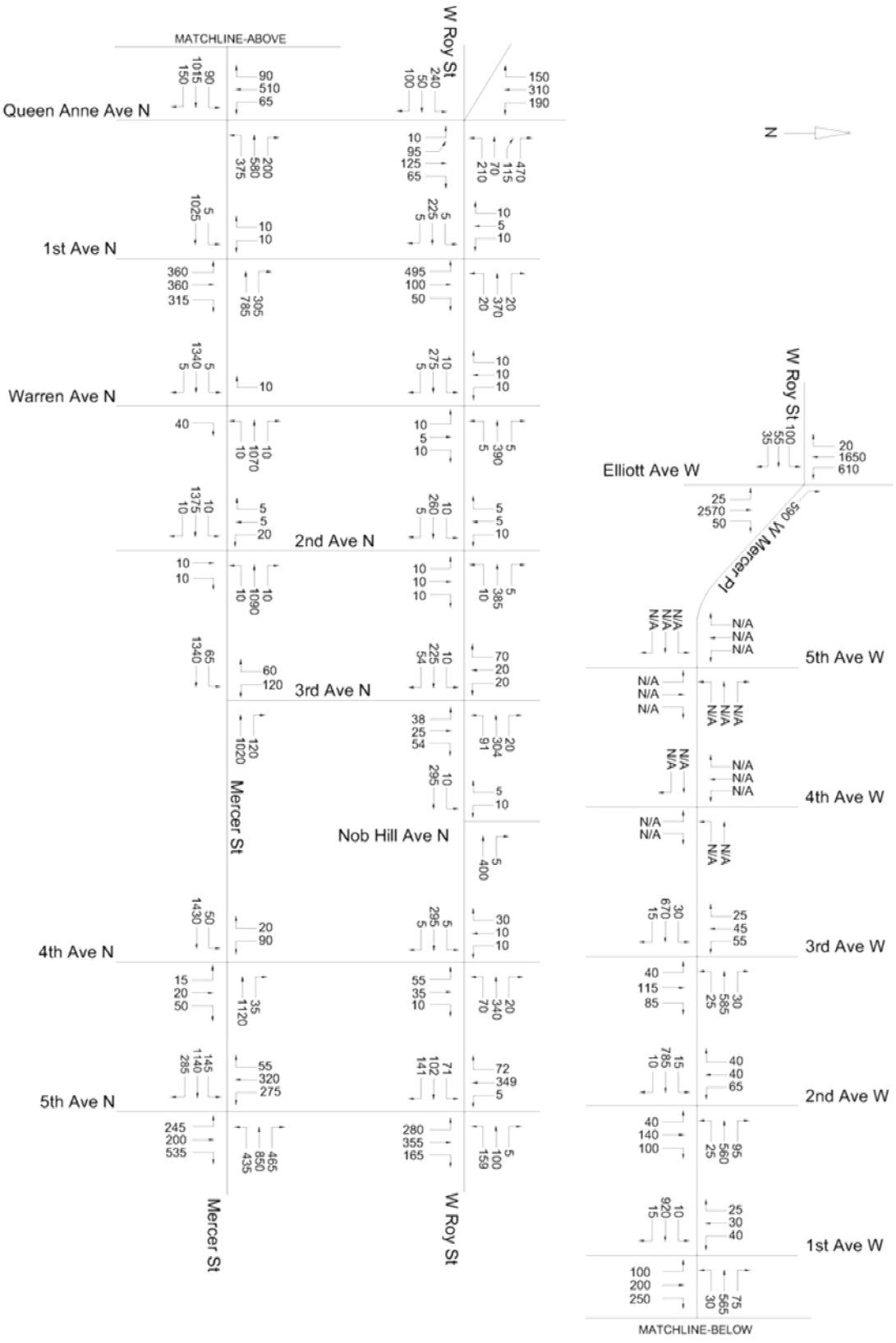


Exhibit 5-12: 2030 Build Volumes (PM)

Intersection Level of Service

The operational analysis of 2030 horizon year AM and PM peak hour No Build and Build conditions were performed for each intersection in the study area using Synchro for LOS and average signalized intersection delay. LOS results for each time scenario are shown in Exhibit 5-13, Exhibit 5-14, Exhibit 5-15, and Exhibit 5-16. Intersections experiencing LOS D or worse in any of the 2030 scenarios are listed in Table 5-2.

Table 5-2: Comparison of Critical Intersection Delays and LOS (2030)

	2030 No Build		2030 Build	
	AM	PM	AM	PM
W Mercer Pl & Elliott Ave	F (121.4)	F (121.6)	F (133.0)	F (152.5)
Mercer St & First Ave W	A (5.7)	C (29.7)	A (5.7)	E (64.7)
Mercer St & Queen Anne Ave N	C (20.8)	B (12.4)	F (89.0)	E (56.9)
Mercer St & Fifth Ave N	F (104.7)	F (98.4)	E (62.8)	F (96.8)
Roy St & Queen Anne Ave N	C (20.7)	B (16.5)	D (43.8)	F (88.1)
Roy St & First Ave N	A (5.7)	B (10.7)	B (10.6)	D (54.2)
Roy St &Fifth Ave N	E (74.1)	E (70.6)	C (28.5)	C (25.7)

AM Peak Hour Analysis

Under the AM peak hour 2030 No Build condition, most intersections are forecasted to experience a LOS of C or better except for three intersections where the LOS would be D or worse: West Mercer Place and Elliott Avenue (LOS F), Mercer Street and Fifth Avenue North (LOS F), and Roy Street and Fifth Avenue North (LOS E).

In comparison to the AM 2030 No Build condition, the AM 2030 Build condition had four intersections with a LOS of D or worse: West Mercer Place and Elliott Avenue (LOS F), Mercer Street and Queen Anne Avenue North (LOS F), Mercer Street and Fifth Avenue North (LOS E), and Roy Street and Queen Anne Avenue North (LOS D).

In both the 2030 AM No Build and Build scenarios, the intersection of West Mercer Place and Elliott Avenue has an LOS of F due to the high volume of southbound left-turning vehicles and the new development on the west side of the intersection. The other two intersections with LOS D or worse in the No Build condition both improve in the Build condition. The LOS at Mercer Street and Fifth Avenue North improves from LOS F to E. Similarly, the LOS at the Roy Street and Fifth Avenue North improves from LOS E to C. In both cases, these intersection benefit from the extension of two-way operations on Mercer and Roy Streets and the redirection of traffic.

Two intersections experience a degradation of signal operations in the Build condition compared to No Build condition: Queen Anne Avenue North and Mercer Street, and Queen Anne Avenue North and Roy Street. At Queen Anne Avenue North and Mercer Street, the LOS degrades from LOS C to F. The increase in delay can be attributed to the increase in westbound vehicles (particularly the increase in

westbound left-turning vehicles) and the additional signal phases needed for 2-way operation. At Queen Anne Avenue North and Roy Street, the LOS degrades from LOS C to D. This LOS degrades due to the additional 2-way volumes on Roy Street and Queen Anne Avenue, and the additional signal phases needed for 2-way operations.

PM Peak Hour Analysis

Under the PM peak hour 2030 No Build condition, most intersections are forecasted to experience a LOS of C or better except for three intersections where the LOS would be D or worse: West Mercer Place and Elliott Avenue (LOS F), Mercer Street and Fifth Avenue North (LOS F), and Roy Street and Fifth Avenue North (LOS E).

In comparison to the PM 2030 No Build condition, the PM 2030 Build condition had six intersections which are forecasted to operate with an LOS of D or worse: West Mercer Place and Elliott Avenue (LOS F), Mercer Street and First Avenue West (LOS E), Mercer Street and Queen Anne Avenue North (LOS E), Mercer Street and Fifth Avenue North (LOS F), Roy Street and Queen Anne Avenue North (LOS F), and Roy Street and First Avenue North (LOS D).

In both scenarios, the 2030 PM No Build and Build, the intersection of West Mercer Place and Elliott Avenue is forecast to have an LOS of F due to the high volume of southbound left-turning vehicles and the new development on the west side of the intersection. Also in both scenarios, Mercer Street and Fifth Avenue North are projected to operate at an LOS F due to high volume of traffic and turning movements.

The Queen Anne Avenue North intersections at Mercer and Roy Streets experience high average delay in the PM peak hour similar to those in the AM 2030 Build condition. The poor LOS at these two intersections result from 2-way operations, higher volumes, and the additional signal phases needed for the left turn movements.

The intersection of Roy Street and First Avenue North operates at LOS D with the proposed project. The degradation in LOS from LOS B to D is a consequence of the additional volumes, new signal phasing and the conversions of Roy Street and First Avenue North to two-way operations. At West Mercer Street and First Avenue West, the LOS degrades from LOS C to E. The main contributors to congestion at this intersection are higher volumes on Mercer Street (particularly westbound in the PM peak) and operation of the signal with permissive left turns from shared through lanes.

Exhibit 5-13: 2030 No Build Traffic Operations (AM)

Exhibit 5-14: 2030 No Build Traffic Operations (PM)

Exhibit 5-15: 2030 Build Traffic Operations (AM)

Exhibit 5-16: 2030 Build Traffic Operations (PM)

Build Alternative Options

There are additional improvements to the Build Alternative that may be constructed in conjunction with the Build Alternative. These include: Exclusive Pedestrian Signal Phases and the Fifth Avenue North Bike Lane. The analysis of these options is described in this section.

Exclusive Pedestrian Signal Phase Options Analysis

At four intersections in the corridor near high-activity land uses, exclusive pedestrian signal phases have been proposed. Under this option, a special signal phasing and related design treatments would allow an all-way pedestrian walk phase (including diagonal pedestrian movements). The intersections in the study corridor where these pedestrian treatments are proposed are at Roy Street/ Queen Anne Avenue North, Mercer Street/ Second Avenue North, Mercer Street/ Third Avenue North, and Mercer Street/ Fourth Avenue North (existing 2010 pedestrian volumes are shown in Table 4-5).

Adding a special pedestrian only signal phase can add delay to vehicular modes and degrade the intersection level of service. An operational analysis of each proposed pedestrian signal phase was performed under the 2030 Build conditions using Synchro. Table 5-3 compares the LOS and average signalized intersection delay for 2030 AM and PM peak hour conditions with and without the exclusive pedestrian signal phase under the Build conditions.

Table 5-3: Pedestrian Scramble Phase Traffic Operations Analysis

Intersection LOS (Delay in seconds) with Project Improvements				
Intersection	2030 AM Without Pedestrian Scramble Phase	2030 AM With Pedestrian Scramble Phase	2030 PM Without Pedestrian Scramble Phase	2030 PM With Pedestrian Scramble Phase
Roy St & Queen Anne Ave N	D (43.8)	F (91.1)	F (88.1)	F (161.5)
Mercer St & Second Ave N	A (4.3)	A (9.5)	A (2.3)	A (7.7)
Mercer St & Third Ave N	A (2.5)	B (15.7)	B (11.0)	D (37.9)
Mercer St & Fourth Ave N	A (9.0)	C (21.9)	B (17.6)	F (116.9)

The average signalized intersection delay increases with the addition of a pedestrian scramble phase for each intersection in both the AM and PM peak periods. Mercer Street and Second Avenue North is the only intersection where the LOS remained the same. All other intersections, particularly in the PM peak period, see a significant increase in average signalized intersection delay. For example, the LOS at Mercer Street and Fourth Avenue North decreased from LOS B without the pedestrian scramble to LOS F with its implementation.

Fifth Avenue North Bike Lane Option Analysis

As an additional option to the Build Alternative, a bicycle lane has been proposed on Fifth Avenue North that would be created by restriping the existing street cross-section. In order to accommodate the bike lane, one of the vehicle travel lanes on Fifth Avenue North would be reduced by one. In the 2030 Build baseline condition; there are two southbound lanes on Fifth Avenue, expanding to three lanes at Mercer Street, including a left-turn pocket approaching the intersection, and three receiving lanes. Northbound on Fifth Avenue North, there are four lanes approaching Mercer Street, including a right-turn lane and a left-turn pocket, which reduces to two receiving lanes and reduces again north of Roy Street to one lane. Since there is more northbound traffic then southbound traffic, the option being considered is to remove one of the southbound lanes to provide enough cross-section to create the bike lane. Based on this new lane configuration, an operational analysis was performed for the intersections of Mercer Street and Fifth Avenue North, and Roy Street and Fifth Avenue North. The results are shown in Table 5-4.

Table 5-4: Fifth Avenue North Bike Lane Traffic Operations Analysis with Proposed Project

Intersection LOS (Delay in seconds)				
Intersection	2030 AM Without Bike Lane	2030 AM With Bike Lane	2030 PM Without Bike Lane	2030 PM With Bike Lane
Roy St & Fifth Ave N	C (28.5)	C (28.5)	C (25.7)	C (25.7)
Mercer St & Fifth Ave N	E (62.8)	E (63.7)	F (96.8)	F (115.4)
Southbound Approach LOS (Delay in seconds)				
Intersection	2030 AM Without Bike Lane	2030 AM With Bike Lane	2030 PM Without Bike Lane	2030 PM With Bike Lane
Roy St & Fifth Ave N	C (25.6)	C (27.1)	B (15.8)	B (17.5)
Mercer St & Fifth Ave N	D (35.0)	D (42.5)	D (41.5)	F (113.8)

* Note: Analysis assumes the conversion of one southbound auto lane to a bike lane

Table 5-4 shows the average signalized intersection delay with and without the bike lane configuration under 2030 AM and PM peak hour conditions, first for the intersection as a whole and then specifically for the southbound approach. The overall intersection delay is minimally affected by the removal of one southbound lane in the AM peak hour but adds almost 20 seconds of average delay in the PM peak hour. The biggest impact is seen at Mercer Street and Fifth Avenue North for the southbound approach in the PM peak where the signalized intersection delay increases from 41.5 seconds to 113.8 seconds, and the related LOS would change from LOS D to F.

CHAPTER 6
Mitigation

Project Construction Impacts and Mitigation

Signal Modification Requirements

Existing traffic signals and pedestrian crossing signals will be modified to accommodate two-way traffic operation on Mercer Street and Roy Street and to improve safety for auto traffic and pedestrians. The locations requiring modified traffic signals and pedestrian crossing signals include:

1. Mercer Street and Queen Anne Avenue North
2. Mercer Street and First Avenue North
3. Mercer Street and Second Avenue North
4. Mercer Street and Third Avenue North
5. Mercer Street and Fourth Avenue North
6. Mercer Street and Fifth Avenue North
7. Roy Street and Queen Anne Avenue North
8. Roy Street and First Avenue North
9. Roy Street and Third Avenue North
10. Roy Street and Fourth Avenue North
11. Roy Street and Fifth Avenue North

Work at these traffic signals will consist mostly of changing signal cabinets, installing signal mast arm poles, installing conduit, hanging and moving signal displays, installing new wiring, and installing vehicle and pedestrian detectors. Most of this work will be conducted off road with lane closures only needed for equipment or material delivery. Crossings and walkways around all construction will be maintained.

The project generally is expected to require a minimum amount of disruptions during construction, as there is not a large quantity of earth-moving required to implement this project. The primary requirements will involve traffic control and signage modifications.

During construction, the City will employ a variety of strategies and construction methods to avoid or minimize impacts to motorized and non-motorized traffic and to Metro Transit service and facilities during construction of the Project.

General Contractor/Construction Manager Procurement and Scheduling

The City intends to use the General Contractor/Construction Manager (GC/CM) alternative public works procurement method to procure construction of the Mercer West project. GC/CM procurement allows selection of a contractor early in the design of the project, based on qualifications and proposed project approach. The selection will be informed by the GC/CM's demonstrated ability to address complex construction coordination and scheduling challenges, such as those presented by the need to coordinate

construction with Metro Transit service and facilities in ways that avoid or minimize impacts to that service. The GC/CM provides preconstruction services, including early development of construction scheduling, staging, and methods in consultation with project stakeholders. The GC/CM will work with the City to develop a schedule that will successfully coordinate with area retailers, Seattle Center and area residents; Seattle Center events and other neighborhood events, festivals, and parades; and with major projects, including construction of the North SR 99 Tunnel Portal or Mercer Street Underpass construction. Work will be scheduled around special events at the Seattle Center or other regional events creating significant vehicle or pedestrian activity.

Work Zone Planning and Duration

Most of the construction on this project will be constructing traffic signal modifications. Signal work is relatively light construction performed during non-peak hours and normally taking no more than one lane closure at a time. Minor sidewalk and curb construction will be performed at spot locations with the same care of the signal work with demolition and new construction in quick sequence. Minor parking restrictions may be necessary for short durations.

Following Seattle's Traffic Control Manual for In-Street Work and the Manual on Uniform Traffic Control Devices (MUTCD) the construction will meet safety standards and pre-analysis of traffic volumes will assure the general public will not experience excessive delays. All lanes will remain open during peak hours and hours of no construction activity. Also, special attention will be paid to off-street work to assure pedestrians will have clear and safe passage through the construction work. All hazards to non-motorized traffic will be removed or blocked from public access when work sites are unattended. All driveways, garages and local access will remain open.

When two-way traffic is initiated, redundant oversized flagged warning signs will be utilized in an effort to gain motorists attention and compliance. Over signing will remain in effect until motorists adjust to the new traffic patterns. Non controlled pedestrian crossings will also have warnings for pedestrians to look both ways before crossing. New signal displays or traffic signs will remain covered until opening of two way traffic. Pavement marking removal and installation will occur immediately before changeover to two-way systems.

King County Metro Trolley Wires

Five of the eleven traffic signals on this project have King County Metro trolley bus routes leading through their respective intersections. The trolley wiring may remain in place during construction and while serving the new lane assignments. However, the lines may need to be de-energized for short periods of time while signal workers work near the lines to make traffic signal modifications.
Other construction activities, such as utility connections, platform construction, and installation of overhead poles are limited to small work areas that limit impacts to traffic and transit operations. Some utility installations to replace conflicting utilities may be completed in advance of traffic signal construction, and these utility projects will be coordinated with Metro according to standard procedures for utility work.

Electrical Clearances - Construction Equipment, Night/Weekend Work, Motoring

The trolley bus network presents unique construction coordination requirements, as clearances from the energized trolley bus contact wires must be maintained for safety. The excavation equipment used for roadway pavement demolition and removal may require adjustment or de-energization of the overhead wires to achieve the required clearances. The requirement can be addressed by using alternative construction equipment and methods where feasible; by completing the conflicting activities on night or weekend shifts that allow for temporary replacement of trolley bus service with diesel bus service on affected crossing routes; or by arranging for "motoring" the trolley buses through the work zone (de-wiring, pushing or coasting the vehicle through the zone, and re-wiring). On some routes, temporary routing changes may be feasible. The City and GC/CM will coordinate with Metro Transit to select the most appropriate method for each construction location.

Operating Clearances - Trolley Wire Adjustments, Motoring, Dieselization

To provide operating clearances for Metro Transit to operate through work zones, temporary traffic control measures will delineate a travel lane, typically 11 feet wide, adjacent to the work zone. When the work zone occupies the lane normally traveled by a trolley bus, the trolley poles typically allow the bus to be as much as nine feet from the center line of the trolley wires. When the location of the work zone exceeds the reach of the trolley poles, options include temporary adjustment of trolley wire locations; "motoring" through the work zone as described above; and temporary replacement of trolley bus service with diesel bus service on affected crossing routes during night or weekend work shifts. On some routes, temporary routing changes may be feasible. The City and GC/CM will coordinate with Metro Transit to select the most appropriate method for each construction location.

King County Metro Passenger Stops - Temporary Relocations, Temporary Closures

When the construction zone conflicts with access to a Metro Transit passenger stop, a temporary stop may be provided in nearby curb space, or the stop may be temporarily closed. The City and GC/CM will coordinate with King County Metro Transit to select the most appropriate method for each construction location.

Project Mitigation

Many intersections are projected to remain at the same level of service or improve their level of service as a result of implementing the project. A few intersections are projected to operate at a degraded level of service as a result of the introduction of two-way operations. A summary of potential mitigation is provided below:

Queen Anne Avenue North/Mercer Street. This intersection is proposed to be modified to allow two-way traffic on Mercer Street and Queen Anne Avenue. As a result of the two-way operational changes, the intersection signal timing and phasing must be significantly modified. The LOS is forecasted to degrade from LOS C to F in 2030 in the AM peak hour, and from LOS B to E in 2030 PM peak hour. Potential mitigating measures include:

- Maintain Queen Anne Avenue North as one-way southbound between Roy Street and Mercer Street.
- Restrict left turn movements.

Queen Anne Avenue and Roy Street. This intersection is also proposed to be modified to allow several additional movements and two-way operations. As a result, the intersection signal timing and phasing must be significantly modified. The LOS is forecasted to degrade from LOS A to D in 2030 in the AM peak hour, and from LOS B to F in 2030 PM peak hour. Potential mitigating measures include:

- Maintain Queen Anne Avenue North as one-way southbound between Roy Street and Mercer Street.
- Restrict left turn movements.
- Provide a 2-lane roundabout.

First Avenue West and West Mercer Street. This intersection is projected to have additional traffic volume in the 2030 PM peak on West Mercer Street as a result of two-way operations on Mercer Street east of Queen Anne Avenue. The LOS is forecasted to degrade from LOS C to E in 2030 PM peak hour. Potential mitigating measures include:

- Provide left turn pockets on Queen Anne Avenue.
- Restrict left turn movements.